Heating and Ventilating

Volume 29 MAY, 1932 Number 5

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Wide World

Progress of construction on Rockefeller Center on April 7. In the foreground is the foundation for the 70-story building. The nearly completed 31-story R. K. O. Building towers in the background. The Opera will be located to the left of the foreground, with the Music Hall in the rear center

Rockefeller Center

I

The first of a series of officially authorized articles on the heating, ventilating and air conditioning of Rockefeller Center (Radio City). General features of this $250,000,000 building project are described in the accompanying chapter.

FROM a standpoint of sheer size and spectacular magnificence, no private commercial enterprise has ever approached—at least in modern times—the development now under construction in midtown New York and known as Rockefeller Center. It is probable, and justly so, that no building project has so stirred the imagination of the public as this amazing and elaborate group of buildings which seems destined to become an international business, financial and entertainment center. It will include the largest office building in the world in point of floor area, the world's largest theater, and the finest collection of contemporary art ever presented in connection with a commercial building development. It will contain over a mile of shop frontage, and over 4,000,000 sq. ft. of office space. The opera and theaters will have a combined seating capacity of 13,900.

Due to the publicity given to certain large leases—Radio-Keith-Orpheum, National Broadcasting Company, Radio Corporation of America, and affiliated concerns—the development in its earlier stages became popularly known as "Radio City." The public was informed last March that "The Board of Directors . . . has considered carefully the question of a fitting name for the development sponsored by John D. Rockefeller, Jr., and located between Fifth and Sixth Avenues from 48th to 51st Streets . . . it is considered an appropriate time to announce an official and permanent name for the entire Development. This name will be Rockefeller Center."

Such world-wide publicity has been given to the philanthropic work of the Rockefellers, notably Rockefeller Institute, that many people have assumed that the Rockefeller Center development was more of an altruistic project than a purely commercial enterprise. This is not the case. The development has been planned throughout so as to pay its own way.

What the Project Comprises

Comprising the group are eleven buildings (some of which are subdivided), consisting of a 70-story office building—the central tower—two 6-story office buildings, two 9-story office buildings, two 45-story office buildings, a 31-story office building, a music hall which will seat 6100 persons, an opera house to seat 4300, and a sound motion picture theater to seat 3500. The area included covers three city blocks—almost 12 acres—of which the buildings cover nearly 422,000 sq. ft. Large areas have been devoted to a new street, a promenade from Fifth Avenue, and a large central plaza—all to avoid traffic congestion and to provide the maximum amount of light and air in office buildings.

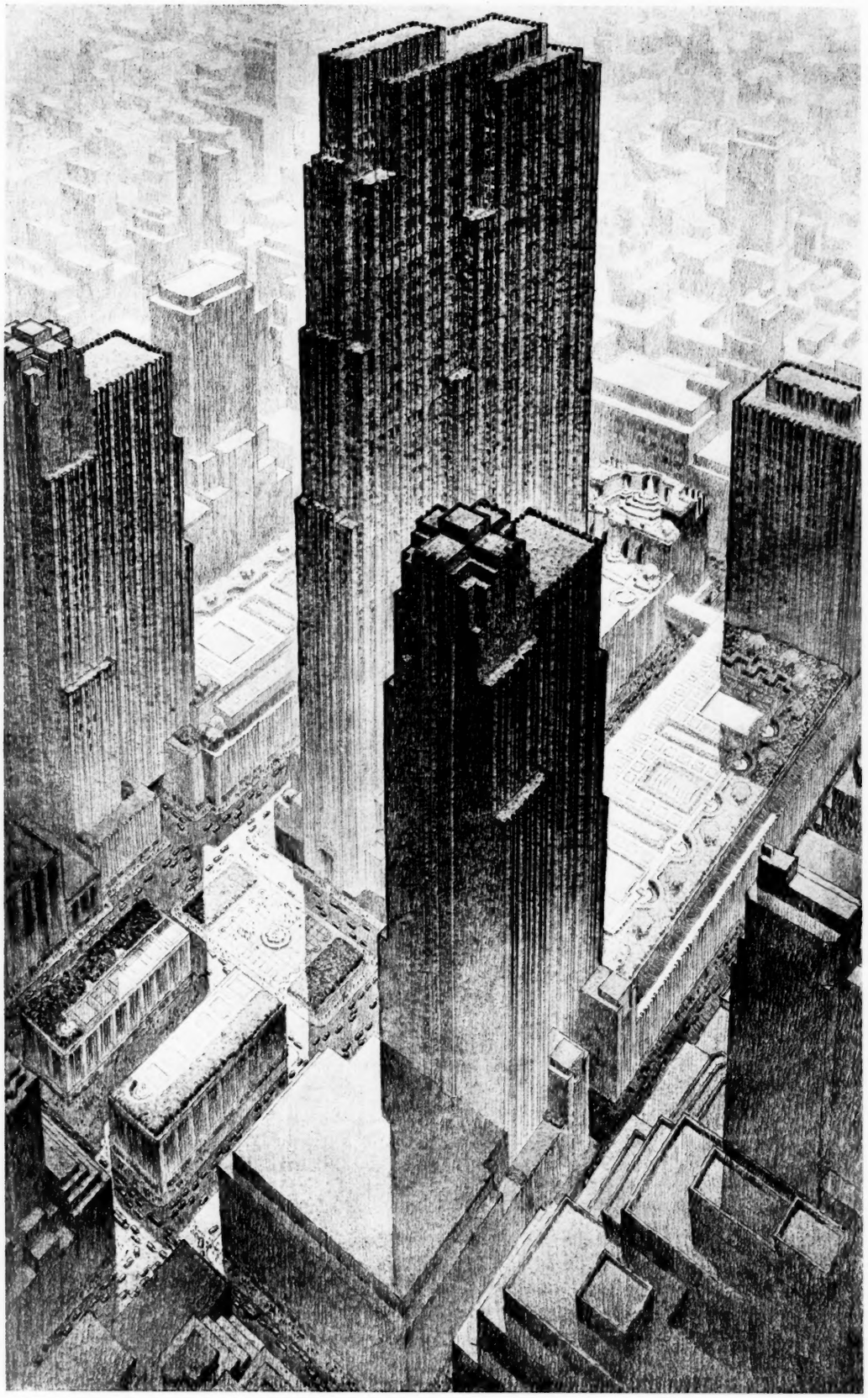
The accompanying table summarizes the general data on the buildings. Cold figures, however, can give no idea of the elaborate arrangements which have been made to provide for the maximum amount of light and air, to provide for future traffic conditions, and to beautify the entire project.

No.	Height, Stories	Type	Ground Area, Sq. Ft.	Name
1	70	Office Building	99,770	—
2	6	"	14,084	La Maison Francaise
3	6	"	14,084	British Empire Bldg.
4a & 4b	9	Office Buildings	40,167	—
5a & 5b	45	"	21,472	—
6	45	"	21,472	—
7	9	"	39,279	—
8	(89 ft.)	Theater	36,420	R. K. O. Theater
10a	31	Office Building	11,126	R. K. O. Bldg.
10	(121 ft.)	Theater	60,672	Int. Music Hall
—	(121 ft.)	Opera House	63,355	Opera House
		Total	421,901	

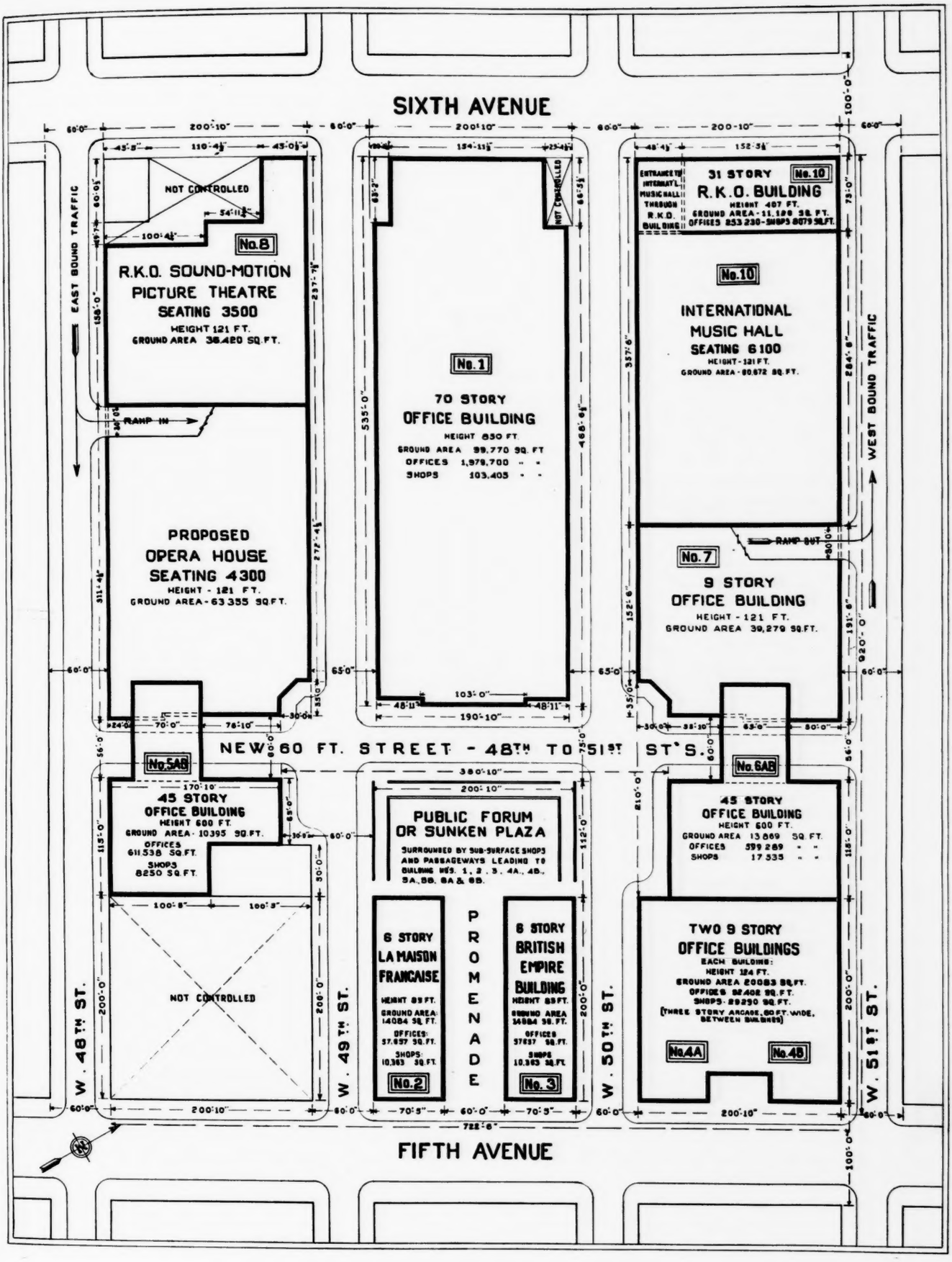
Referring to the general layout, attention is immediately focused on the 70-story office building. This is set back from Fifth Avenue about 400 ft. Occupying the space between the tower and Fifth Avenue are two 6-story buildings on the Avenue, with a promenade 60 ft. wide between. The promenade, providing a dignified and impressive Fifth Avenue approach to all buildings, leads into the central Forum or sunken plaza facing the central tower.

The plaza serves three purposes: it is a sunken garden from which shops open, and is also the entrance to the whole system of shops on the basement shopping level underlying practically the whole development; it creates a shopping level on the underground floors and constitutes a shopping center for the project, and it makes a beautiful setting for the office buildings adjoining it.

A notable feature of Rockefeller Center, and of particular interest to engineers and architects, is that the design of the whole project has been a *progressive* one. The first plans were made public in the spring of 1931, and changes have been made continuously, not only in details of buildings but in the major design of whole buildings. It is easy to understand that, from the standpoint of promotion and leasing, any idea proposed at first might be partially unworkable. This was the case with Rockefeller Center. When it was found im-



Rockefeller Center as it will appear from a point almost directly over St. Patrick's Cathedral



Ground plan of Rockefeller Center

possible or inexpedient to include a certain building of a given design (perhaps because of renting conditions) the plan was changed so as to provide for the accommodation of an entirely different class of building. Too, as the plan progressed, further refinements suggested themselves, which on an ordinary project might have meant simple adjustments, but in a development of this size meant a rearrangement of many facilities.

Since the design has been progressive, minor changes are still taking place, and probably will continue until the last building is erected. This is particularly true of the 45-story office buildings, the proposed opera house, and the future 9-story and 6-story buildings.

The general features of Rockefeller Center are so closely tied up with the individual buildings that a description of these points cannot be discussed without an understanding of the general features of the specific buildings. Although the details of several of the structures have not as yet been decided upon, the size and probable arrangement are more or less definite. With this in mind, a fairly comprehensive description of the buildings follows:

Building One—70-Story Office Building

The main entrance of this 70-story skyscraper faces on the sunken Plaza, and the tower of the building rises at this end. At the Sixth Avenue end the building is 301 ft. high, and this part is joined to the tower by a section 150 ft. high. The building is 535 ft. long and 191 ft. wide in plan. The height to the top of the main tower is approximately 850 ft. Of the total floor space, 103,405 sq. ft. will be devoted to shops and 1,979,700 sq. ft. to offices. In addition to the shop space, the first floor and first mezzanine will include a large continental type restaurant, with dining terraces to seat 1800 people.

The remainder of the first floor and first mezzanine floor will be devoted entirely to shops and service space. The third to eleventh floors will be occupied by the offices and studios of the National Broadcasting Company and by a few rentable offices. The greater part of this space will be blanked off from the rest of the building and the outside by sound insulation, and it is expected that, inasmuch as this space will be air conditioned, the window space will be little needed. One distinctly fine feature embodied in the design of all office buildings in the group is that no office space will be more than 27½ ft. from an outside window opening. Practically all office windows will look out upon the gardens on the lower roofs of other buildings in the development.

Galloway

The British Empire Building

R. K. O. office building with International Music Hall in the background.

Building Ten—International Music Hall

The Music Hall is designed for the exhibition of revues and spectacles on a large scale. It will be operated by the Radio-Keith-Orpheum Corporation, and under the management of S. L. Rothafel ("Roxy") of broadcasting fame. Mr. Rothafel will also direct the operation of the R.K.O. Sound Motion Picture Theater. Some time ago he severed his connection with the theater which bears his name and has devoted more than a year to extensive travel and investigations in search of new talent and new ideas to be used in connection with future productions in these two theaters. His studies and investigations have had a marked effect on the design of both buildings, particularly with regard to interior arrangements and facilities.

Although the Music Hall is designed for entertainment in the form of spectacles or high grade vaudeville,

it can be converted, if desired, to use for legitimate shows or sound motion pictures. The hall will seat 6100 persons, of which 3500 will be seated in the orchestra section.

The International Music Hall will cover 60,672 sq. ft. of ground area and will be 121 ft. high. The air conditioning system will have a capacity of 600 tons, and will supply 40 c.f.m. per person, a total of nine tons of conditioned air per minute.

The type of show to be produced and the size of the theater make the design of special equipment of unusual interest. In the Music Hall, specially designed stage and theater lighting equipment will make possible the production of any shade of the spectrum or any color combination required to bring out or to harmonize with the varying spirits or moods of different scenes upon the stage. Indirect lighting will be employed in the auditorium, the ceiling and walls of which have been designed for this purpose. One of the principal decorative effects will be a sun burst emanating from the top of the proscenium arch and diffusing its rays over a series of overlapping arches which form the side walls and ceiling of the main auditorium.

The stage, 143 ft. wide and 62 ft. deep, will be provided with a system for producing lighting effects of unusual scale and diversity.

A traveling orchestra platform, or "band wagon," is one of the interesting features of this theater. Employing a system of tracks and elevators, actuated by motors under the control of the orchestra leader, the "band wagon" can be raised or lowered or made to travel under the stage to a position in the rear and then raised to a height of 13 ft. above the stage. A turntable, 40 ft. in diameter, located in the center of the stage, can be revolved in either direction while being raised or lowered.

The exterior of the Music Hall has been designed to harmonize with the general theme of the architecture throughout the development. A formal garden on the roof, one of a series extending over the lower roof areas of all buildings in Rockefeller Center, will be patterned after the gardens of old Spain, and will have fountains, pools, grass plots, shrubbery and trees. An artistically designed bridge across 50th Street will lead to another garden on the lower roof area of the 70-story office and studio building between 49th and 50th Streets.

Studios and rooms for rehearsals, broadcasting, previews and tryouts will be located in the truss space directly over the main auditorium. In the basement area directly beneath the grand foyer will be a club room with lounges and rest rooms at either end. The remainder of the basement space will be occupied by mechanical (including air cleaning and cooling) and electrical equipment and other facilities.

Building Eight—Sound Picture Theater

The Sound Motion Picture Theater, also leased to and to be operated by the Radio-Keith-Orpheum Corporation, will have the most complete system of sound reproducing and amplifying equipment ever designed. The theater will seat 3500 persons, and is expected to be completed in the fall.

Four standard size photophone reproducing units; an 80 watt double channel amplifier in the projection booth, and four 50 in. loud speakers on the stage will be used in connection with the reproduction of sound motion pictures. In addition, there will be a public address system, with 25 microphones to reinforce the stage productions.

Unusual features of the installation include a rehearsal system for use in connection with the direction of productions; a stage manager's call system, and 52 acousticon seat phones, attached to selected seats for the benefit of the slightly deaf. Complete radio and phonograph equipment in the projection booth will make it possible to transmit radio or phonograph programmes to the audience at any time.

This theater will be supplied with five tons of conditioned air per minute. Three refrigeration machines, with a capacity of 225 tons, will cool the air.

Other Buildings

Sizes and locations of the other buildings are shown in the general plan of the Development. The other buildings include:

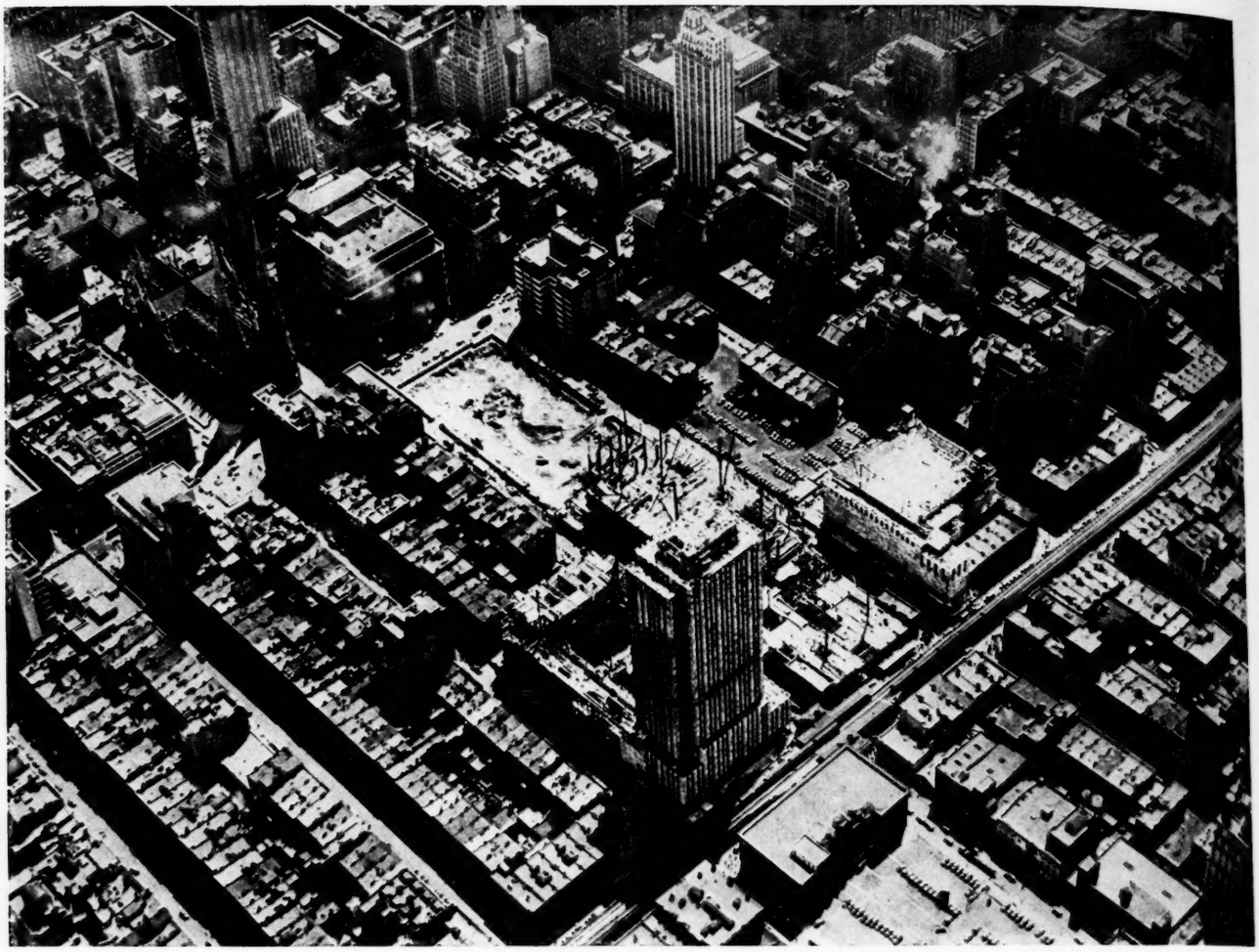
Proposed Opera House. Details of this building have not been made public. It will be recalled that when Rockefeller Center was first talked of it was in connection with the possibility of building an amusement center which would house the Metropolitan Opera. At the present time negotiations to this end have not been completed.

The building will be 121 ft. high, 285 ft. long and 110 ft. wide. It seems reasonable to suppose that structural details will not be completed until definite arrangements are made as to whether or not the Metropolitan Opera is to be housed here.

Buildings 5 and 6. These will be 45-story office buildings, 600 ft. high, with shops on the first floor. So far the buildings have not been named. They will probably be the last buildings to be erected in the development.

Buildings 4a, 4b, and 7. These will be 9-story structures, the former 124 ft. and the latter 121 ft. high.

The R. K. O. Sound Motion Picture Theater



Acme

The three blocks on which Rockefeller Center is being built, as seen from the air April 21.

Building 4 (a and b) will contain 184,804 sq. ft. of office space and 58,580 sq. ft. of store space. Building 7 will have a ground area of 39,279 sq. ft.

R.K.O. Building. A 31-story office building, shown on the plan as 10a. Twenty-four floors of this building will house the offices of the Radio-Keith-Orpheum Corporation. Construction on this building is well advanced, the exterior stone work having been practically finished in April. The building is 407 ft. high, has 253,230 sq. ft. of office space, and 8079 sq. ft. of shop space.

Buildings 2 and 3. These are identical buildings, the former being known as La Maison Francaise, the latter as the British Empire Building. They will be devoted principally to offices, shops and exhibition space for industrial concerns of the respective countries represented. Each building is 6 stories high and each contains 57,657 sq. ft. of office space and 10,363 of shop space.

General Features

The plans show an innovation in architectural city planning. Several acres of intensive landscaping will be devoted to waterfalls, fountains, reflecting pools, trees, shrubbery, formal flower beds, multi-colored tile walks, grass plots and statuary. Plans for covering the outer walls of the buildings with a network of living ivy are also a tentative part of the scenic picture.

Almost an acre of ground space, visible from the street, will surround the sunken plaza, or Forum, with its sculptural fountains and mosaic pavement.

There will be two levels of landscaping above the studios of the National Broadcasting Company, in the lower roof area between the main building and the main east wall of the 16-story wing. These areas will be at the thirteenth and eleventh floor levels and connected by stairways. They will have terraces, formal flower gardens, benches and geometric grass plots, with two or more small fountains. The general appearance will be that of a formal garden.

Extensive landscaping will be worked out on the roofs of the International Music Hall and the Sound Motion Picture Theater. On the north side of the Music Mall and the south side of the sound theater will be 30 ft. hedges of beech, hemlock, or linden, so that to the eye the hedges will form a frame for the picture. The rest of these two roofs will be devoted to formal gardens.

All the roofs and setbacks beneath the 16-story level will be fully landscaped. A complete piping and sprinkling system, underneath the earth, will water the landscaped area.

At the sixty-seventh floor level of the 70-story office building an observation space will be arranged. At the

top, there will be an open esplanade about 30 ft. by 50 ft. This will offer an unobstructed view of lower Manhattan.

The height and location of buildings in the development are in accordance with the "stagger plan," which leading city planners have been urging for years as the architectural solution for the placing of skyscrapers in a modern city. There will be from 200 ft. to 300 ft. between any corner of the bigger building and the nearest diagonal corner of the building most closely adjacent.

The development will have the finest collection of contemporary art, sculpture, and murals ever presented as part of a commercial development. Over forty murals, fifty sets of sculpture, and six acres of roof landscaping, will make the project an international art center.

Traffic congestion, especially in view of the seating capacity of the theaters and opera, has been provided against. Of the total area, 1¾ acres have been devoted to streets and open space. The plan shows a new cross street, 60 ft. wide, in front of the central tower. This roadway will pass under both of the 45-story office buildings, the westerly wings of which will bridge the street.

The magnitude of the project can be better appreciated by totaling some of the material quantities which will enter into the building of Rockefeller Center. Three thousand carloads of structural steel will be required. Other figures include 1700 carloads of cement; 1150 carloads of plaster and plaster block; 91 carloads of radiators, and 60 carloads of plumbing fixtures. The total weight of material used in the development has been estimated as approximately 660,000 tons—the equivalent of over 25,000 carloads.

Engineers have computed that 10,000,000 days of eight hours each will be consumed by the workers who produce, transport, and erect the building. The total number of people employed directly or indirectly will be well over 56,000.

The Organization Behind the Project

At the head of the experienced and comprehensive organization which is financing, designing, building, and managing the project, stands John D. Rockefeller, Jr. His holding company, Rockefeller Center, Inc., headed by Arthur Woods, former police commissioner of New York, has general oversight of the entire project. The active management of the development is handled by Todd, Robertson, Todd Engineering Corporation and Todd and Brown, Inc. (John R. Todd, Hugh S. Robertson and James Todd were important factors in the origination of the project).

The larger part of the land in the three blocks covered by Rockefeller Center has been leased from the Trustees of Columbia University by Rockefeller Center, Inc.

Other important branches of the organization include the Renting Department, headed by L. A. Kirkland; Public Relations Department, in charge of Merle Crowell; Comptrollers Office, in charge of John P. Hanson, and the Legal Department, under Lester S. Abberley.

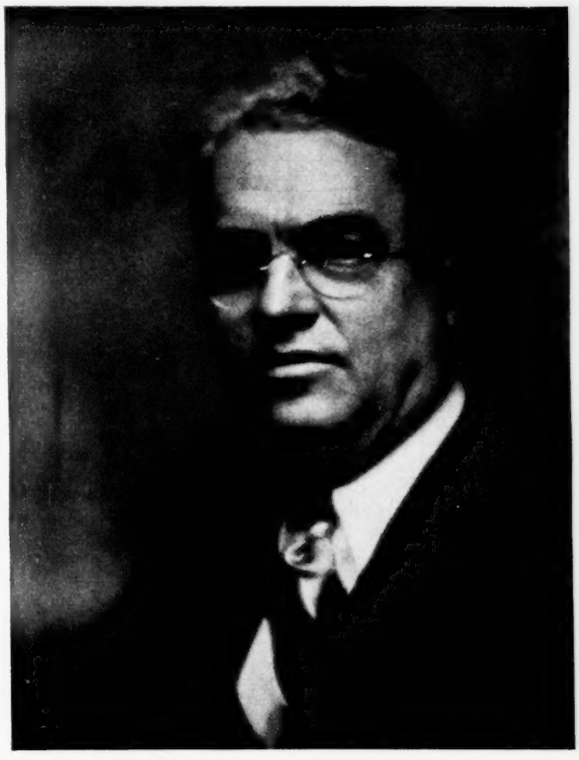
Four architectural firms are associated in the design of the buildings: Reinhard & Hofmeister; Corbett, Harrison & MacMurray; Raymond Hood (who designed the gold-topped American Radiator building); and Godley & Fouilhoux.

Clyde R. Place, who was mechanical engineer on the new Waldorf-Astoria Hotel, was selected as mechanical and electrical engineer; H. G. Balcom was chosen to design the structural work.

Three general contractors are erecting the buildings at present under construction: John Lowry, Inc. (which built the International Magazine Building and Lincoln Safe Deposit Building); Hegeman-Harris Co., Inc. (recent project, the Daily News Building in New York); and Barr, Iron and Lane, Inc. (builders of the Metropolitan Life Insurance Company housing development in Long Island City). Baker Smith & Company are the heating and ventilating contractors.

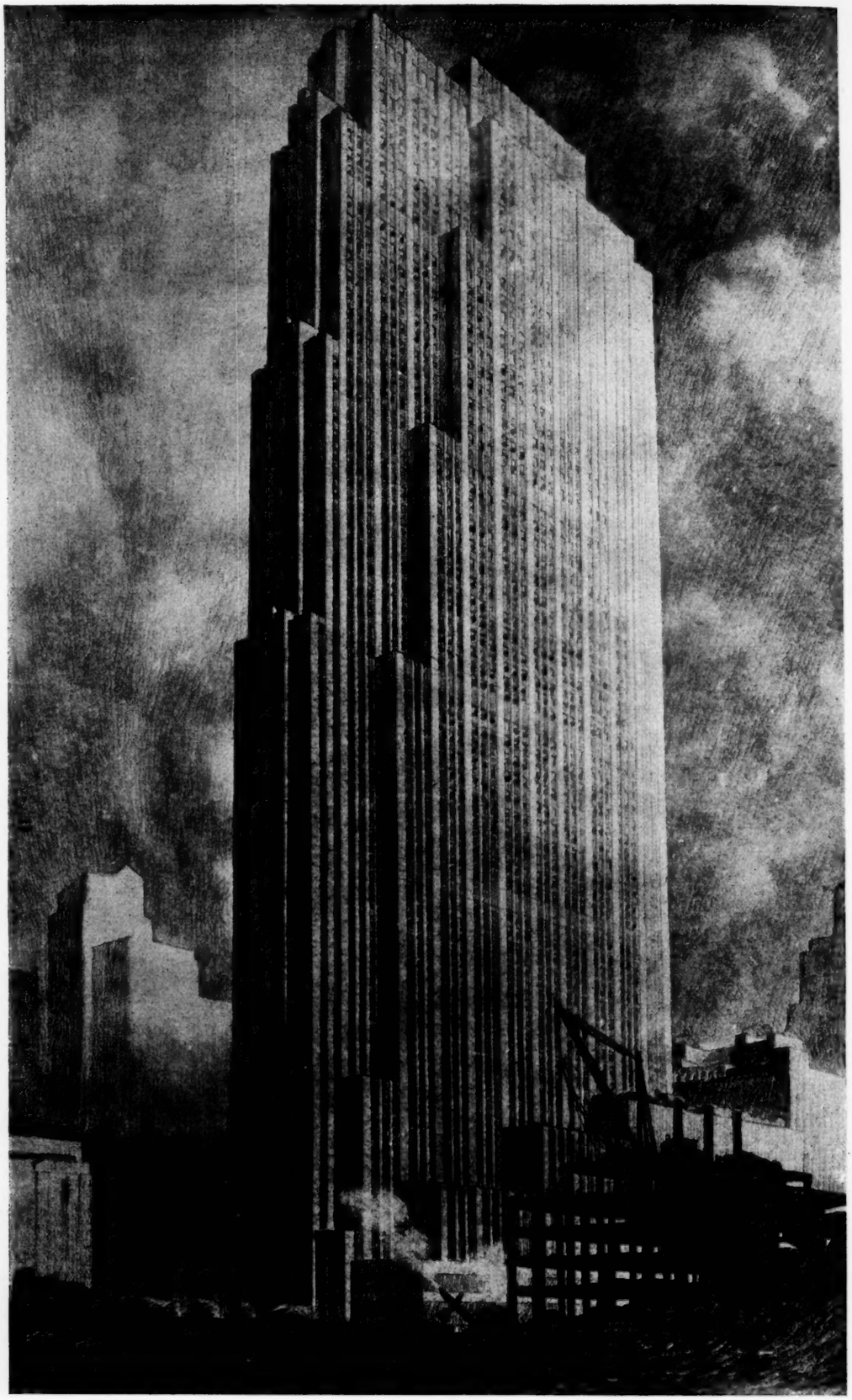
Progress of Construction

The development is roughly planned to be 50% completed by the spring of 1933. The entire development will probably be completed by the end of 1934. The first building to be completed will be the R.K.O. Office Building. Steel work is under construction on the sound theater, the International Music Hall, and the 70-story office building. These theaters and the R.K.O. Building (No. 10) are the ones planned for completion in 1932. The 70-story building will be completed in the spring of 1933.



CLYDE R. PLACE

Consulting mechanical and electrical engineer for Rockefeller Center. Projects on which Mr. Place has performed a similar function include Grand Central Terminal, New York, and many buildings in that district, including the new Waldorf-Astoria Hotel.



The central tower of Rockefeller Center, a 70-story office building, occupants of which will include the National Broadcasting Company.

Heating and Ventilating the 70-Story Skyscraper (Building One)

II

By A. WILSON KNECHT†

The second of a series of articles on the greatest building project of modern times—Rockefeller Center.

DURING the design of Building One, the 70-story office building located on the west (Sixth Avenue) side between 49th and 50th Streets and extending to a point slightly beyond the center of the entire project, it was found convenient to consider the building as two independent sections. Since the original plot plan of the development indicated that Building One would be built on lots numbered 1 and 9, the two assumed sections of the building were numbered in the same manner. Section 9 was considered as that part of the building facing directly on Sixth Avenue and extending to a point approximately 75 ft. east of the Sixth Avenue property line. Section 1 was considered as the remainder of the building extending approximately 460 ft. beyond section 9. The relative locations of these assumed sections 1 and 9 are clearly shown on Fig. 1.

Section 1 presented many interesting problems of design, but before considering them the general purpose and arrangement of the section should be clear. Part of this section extends to a height of 70 stories and will accommodate a number of different kinds of tenants. The first and second floors are designed for occupancy by various types of stores and shops and include a large restaurant and forum. The space between the third and eleventh floors will be occupied by radio broadcasting studios, by the offices of the broadcasting company, and by rentable office space. The remainder of the building above the eleventh floor contains general rentable office space.

Because of this varied occupancy one of the interesting problems was that of proper zoning of the steam heating mains. The effect of the varying outdoor weather conditions on the heating demand in so extensive a building made it necessary to give careful consideration to the zoning to take care of this as well as the varying occupancy.

To provide control of steam to various parts of the building in accordance with the demand, the heating system was divided into seven zones. The "stores system" feeds the first and second floors. The section from the third to eleventh floors is supplied from two separate sets of steam mains, one for the broadcasting spaces and one for the rentable office spaces.

The remainder of the building above the eleventh floor is fed by mains which are located in pipe galleries above the thirty-second, fifty-eighth and sixty-fourth floors. From these galleries steam risers are led up and down, as shown in Fig. 1. Condensate is collected in returns and led to the water heating economizers, but Fig. 1 does not show their location.

Each of these vertical zones is subdivided into two additional zones to provide for variations in heat loss on the different sides of the building due to changes in the direction and velocity of the wind and position of the sun in relation to the building. In subdividing these vertical zones, separate steam mains are provided for supplying the northwest and southeast exposures of the building. Fig. 2 shows diagrammatically the arrangement of the feed lines in one of the pipe lofts. A 50 lb. steam line is carried vertically up the building. A pressure reducing valve room is located in the pipe gallery and the 50 lb. steam is there reduced in pressure and led out to mains which feed either up or down. The main is split immediately after leaving the pressure reducing valves and the branches are taken around the outside of the building. In Fig. 2 it appears that the zoning is north and south only but this is true because of the high ratio of length to width of the building in the sections above the set-backs.

Section 9 presented considerably less of a problem of zoning due to the limited height of 16 floors and comparatively small exposure. The only zoning deemed necessary was that due to differences of occupancy of the building. Since there will be stores on the first and second floors and only office spaces above, two vertical zones were selected, neither of which will be subdivided for the northwest and southeast exposures as is done in section 1. Fig. 2 also shows diagrammatically the zoning of this section.

All of Building One except the broadcasting space is served by a high vacuum heating system which secures control of temperature by varying the steam pressure in the radiators. The broadcasting studios are heated in winter by an air conditioning system, supplemented by radiators in rooms having exterior exposures.

As the heating apparatus has its own control built integrally, it was not considered necessary to use additional controls at the radiators. An ingenious method of averaging the temperatures throughout any single zone is included to determine the required steam pressure which must be maintained to balance heat losses from that zone. An automatic regulator maintains a constant difference in pressure between the steam supply and the vacuum return lines. Additional manual

† Of the Office of Clyde R. Place, Consulting Engineers, New York.

control is provided to enable the operating engineer to vary the desired temperature in each zone, which temperature is automatically maintained thereafter by the controls.

At this point it may be of interest to note that, with very few exceptions, all radiators in the building are to be of the flue type constructed with copper tubing and heavy copper fins.

Each zone throughout the building is supplied with steam through individual pressure reducing valves at each pipe gallery level. These valves reduce the pressure from 50 lb. to 5 lb., after which further reduction to the desired operating pressures is made by means of a second reducing valve in series with the first, and which acts as the heating control valve.

In addition to the medium pressure steam riser for the heating system, a second riser is carried up through the building to supply steam to the hot water heaters and to a future kitchen. Pressure in this line is maintained at approximately 40 lb. to eliminate the necessity for using reducing valves on the steam supply lines to the kitchen.

All steam used in the building is supplied by the utility company whose mains are located in 49th and 50th Streets. Two sources of supply are used in order to insure constant steam supply in case of failure of either street main. Piping is so valved that steam from either street main can be fed as wanted.

Steam enters the building from the street mains at a pressure of approximately 125 lb. After being thoroughly cleaned in steam purifiers, the steam is metered and reduced in pressure to approximately 90 lb., this pressure being carried on the main steam header. As the steam leaves the main header, the pressure is reduced to that required for the several services, such as for heating, hot water heating, ventilation, and the like.

As is common practice in New York when street steam is used, all condensate returns from the heating system and other apparatus is wasted to the sewer. Before being discharged to the sewer, however, the condensate is pumped through economizers or preheaters and cooled by the cold water supply to the hot water heaters. Cooling of the condensate is required for reasons of economy in order that all available heat units be conserved. Cooling is also required by city ordinances which prohibit the discharge of condensate to the sewer at a temperature exceeding 100° F. To insure strict compliance with the law, an automatic (see Fig. 3) regulator is provided in the condensate line between the economizers and the sewer further to cool the condensate by mixing with cold water should the quantity of water supplied to the hot water heaters be insufficient to lower the condensate temperature to 100°.

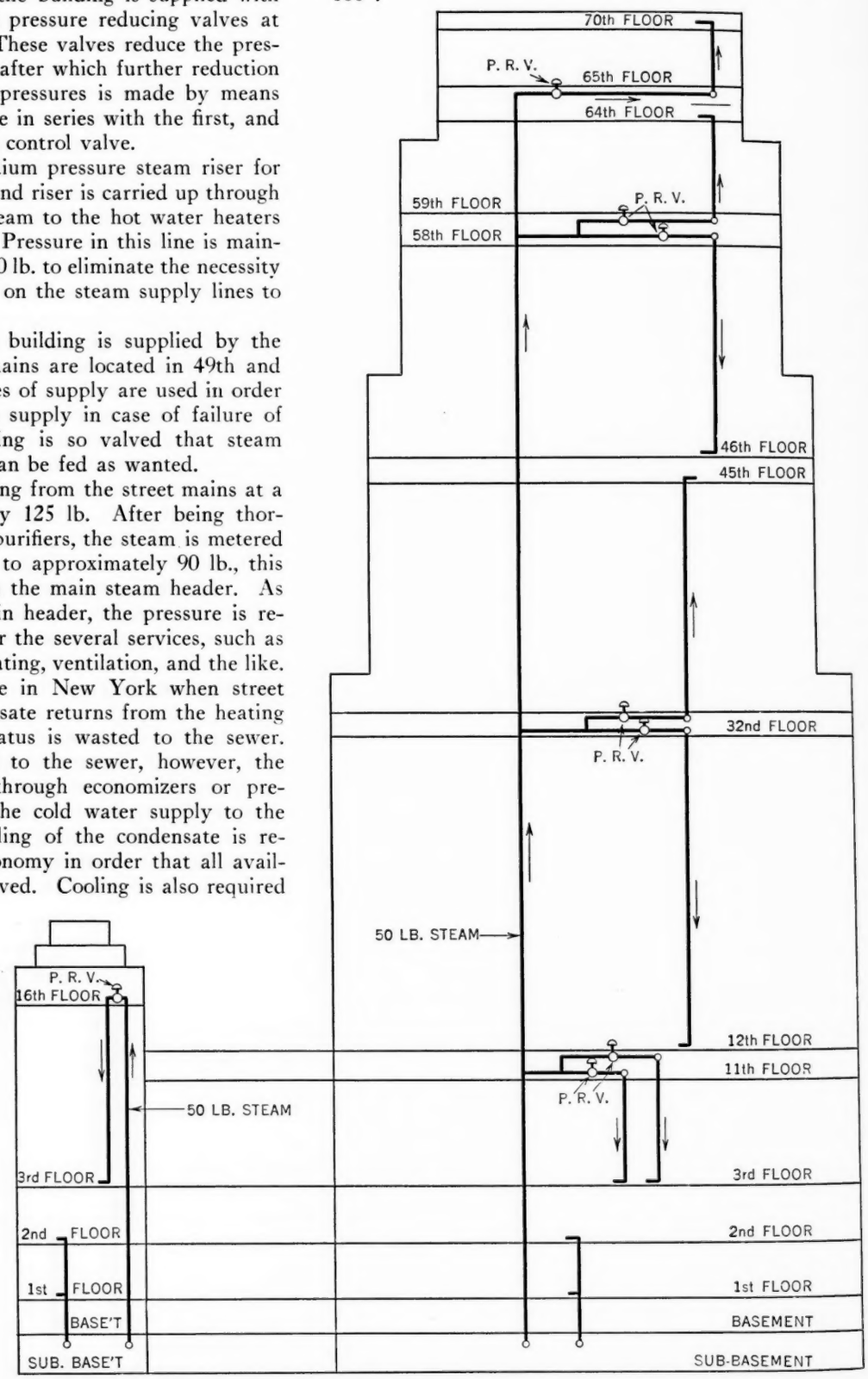


Fig. 1. Diagram of steam distribution system.

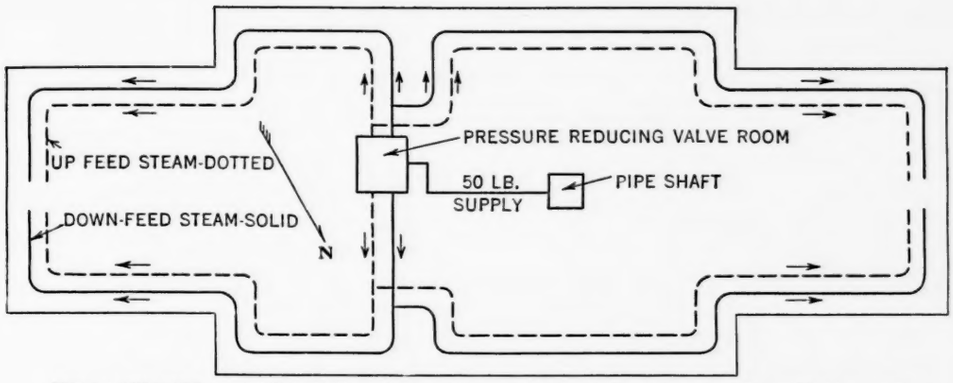


Fig. 2. Diagram showing steam distributing piping in a typical pipe gallery.

Note: "North" and "South" zoning only on Upper Floors where Length is much greater than Width

All possible steps were taken in the design of the heating system to eliminate corrosion, with the result that brass pipe is used at points thought to be particularly subject to corrosive conditions. For example, brass pipe is specified in the horizontal return lines from the hot water heaters and on the air vents from vacuum pumps.

Since construction of piping systems is tending more and more toward welded installations, all steam and return piping over 3 in. in diameter is welded. Selection of competent welders, and rigid welding specifications, together with close supervision in the field, are expected to produce a perfect welding job with a minimum of rejections and leaks when hydrostatic field tests are applied.

The ventilation system consists of mechanical supply and exhaust ventilation for the sub-basement, which contains much of the machinery and building service quarters. All elevator machine rooms and the interior portions of deep offices are also provided with both mechanical supply and exhaust. Mechanical exhaust ventilation only is used for interior toilet rooms and for all utility or slop-sink closets. In addition, a hot blast system is installed to augment the direct heating system in the entrance lobbies of the building.

Besides the regular ventilation, two separate and independent air conditioning plants are included; one for the broadcasting studios and one for the stores, forum and restaurant on the two lower floors.

Ventilation of the elevator machine rooms presented an unusual problem. Due to the architectural treatment of the exterior of the building, it is not possible to install disc fans in the exterior walls as is often done. Squirrel cage fans were not desired inasmuch as the fans have to be placed in the pipe lofts in which the headroom is severely limited. Two-stage impeller disc fans were therefore selected for this service since they do not require much headroom and operate against high static pressures with low tip speeds and little or no noise. Fig. 4 shows a detail of how these fans are insulated to prevent noise and vibration being transmitted to the building.

Another problem encountered was that of maintaining the pipe galleries at a reasonable temperature, for even though steam piping be insulated, heat will still be lost to the surrounding air. If the piping is located in a confined space, such as a pipe gallery, high temperatures result which render the space unfit for a man to stay in for any length of time such as would be required for making repairs and adjustments. In addition, heat flow into offices above and below these galleries might cause complaints from tenants leasing such offices. All pipe galleries in Building One are therefore ventilated by gravity and wind pressure through thermostatically-controlled louver dampers in the four exterior walls. Control of the dampers is by thermostats set at 80°. The thermostats actuate the dampers through electric motors.

A constant source of fresh air is desirable and necessary in all spaces occupied by people for any length of time. Generally speaking, this air supply may be obtained by means of window ventilation when the ratio of the room area to window area is not too great.

Ventilation of offices by means of windows occasionally presents the disadvantage of admitting street noises to the office spaces when the windows are opened. Installation of mechanical supply ventilation for all spaces was considered unwarranted, but it was felt to be highly desirable to provide some means of obtaining noiseless supply ventilation should this be wanted by the tenant.

In view of this requirement, a ventilating device has been used which appears to offer the advantage of permitting easy installation after the completion of the building without being plainly visible from the room, and at the same time providing an efficient means of supplying filtered outdoor air while excluding street noises. The ventilator selected includes a silencer of the Maxim type.

The ventilator proper contains two squirrel-cage type fans driven by a common electric motor. Air is drawn from out-of-doors through specially constructed aluminum sub-sills having concealed openings over the spandrel sections, is filtered through two easily renewable filter screens, and delivered into the room after passing through a silencing chamber designed effectively to exclude street noises. The ventilator housings are so combined with the radiator enclosure that an observer would not suspect their presence except by noticing the supply air grilles provided in the top of the enclosures. Various refinements of construction are included such as an automatic switch to stop the fan motor when the damper on the discharge grille is closed. The combination radiator and ventilator does not extend into the room any more than is usually the case with a radiator and enclosure alone, and presents an unusually good appearance.

The radiators and enclosures are installed during

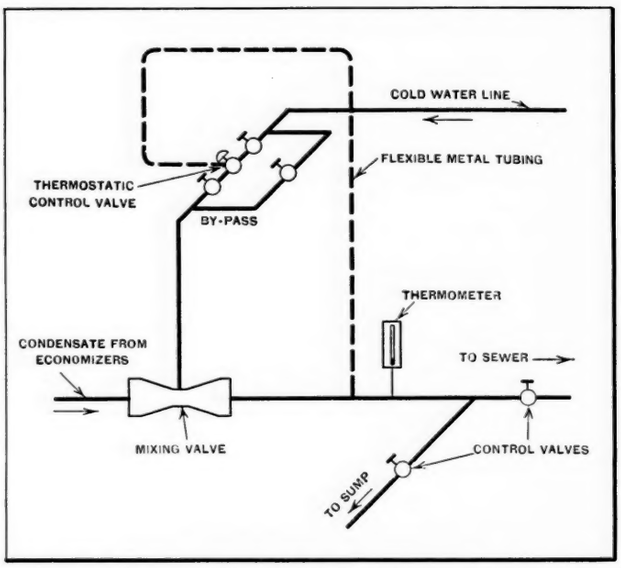


Fig. 3. Diagram of the arrangement for cooling the condensate before discharge

the erection of the building, but the ventilator units will not be installed until desired by the tenant. Sheet metal boxes to support the ventilator units and baffles to separate the radiator enclosures and ventilators are installed during construction, together with aluminum cover plates to seal the opening between the ventilator suction and air intake. When the ventilator is to be installed, the only necessary steps will be to remove the front of the enclosure, radiator, baffle and cover plates, insert the ventilator unit, replace the radiator, etc., and connect the motor leads to a base plug already provided within the enclosure.

While automatic control at the radiators will not be required where the high vacuum system of heating is installed, this system does not control the heating of the broadcasting studios, the majority of which are interior rooms having no radiators. A few offices and supplementary rooms on these floors will be on the exterior of the building, and these rooms will be provided with radiators. All such spaces, however, are heated by means of the air conditioning system, supplemented in the case of exterior rooms by radiators. These radiators are automatically controlled by means of a pneumatic system to maintain the desired temperatures in the rooms without imposing too great a heating load on the air conditioning system.

An additional pneumatic temperature control system is provided in connection with the radiators in the restaurant and forum, which are also air conditioned.

It is of interest to note that all systems for the radio broadcasting studios are entirely independent of similar systems for the remainder of the building. The reason for this segregation is apparent when it is realized that the systems will not operate during the same hours and that an advantage is gained by segregating all costs of steam and power for each portion of the building.

With the large number of fans distributed throughout the building, it would be next to impossible for the operator in charge to be sure at all times that the proper fans are in operation and have not been stopped for some reason unknown. The same would also apply to the steam pressure reducing valves on the upper levels, although in this case a hazard would be introduced due to the possibility of excessive pressures. For this reason, a signal system was designed to warn the engineer of the starting or stopping of any fan, or of a pressure in excess of the setting of the alarm system on the low pressure side of any steam pressure reducing valve above the sub-basement.

As designed, the signal system for the fans consists of an individual pilot light for each fan above the ground floor, except disc and impeller type fans, and a common gong for all fans. A three-way snap switch is also provided for each fan so that the gong may be turned off from that particular fan without affecting the pilot light. A relay mounted on each controller is connected in parallel with the fan motor after the circuit breaker and controller. The fan relay coils are wound for 208 volts, 60 cycle, a.c., but the relay contacts and other equipment are designed for use with 120 volts, a.c.

The wiring diagram shown (Fig. 5) includes alarms for two fans only, the wiring being the same for any additional alarms. The action of the fan alarm system is as follows: With the fan operating, the switch is in the "run" position and the light out because of the open circuit maintained by the fan relay. When the fan stops, the fan relay closes the circuit, lighting the pilot light and raising the armature of the two-pole, double-throw secondary relay, thereby ringing the bell. The bell may then be turned off by the operating engineer by throwing the switch to the "stop" position, the secondary relay remaining in the raised position and the pilot re-

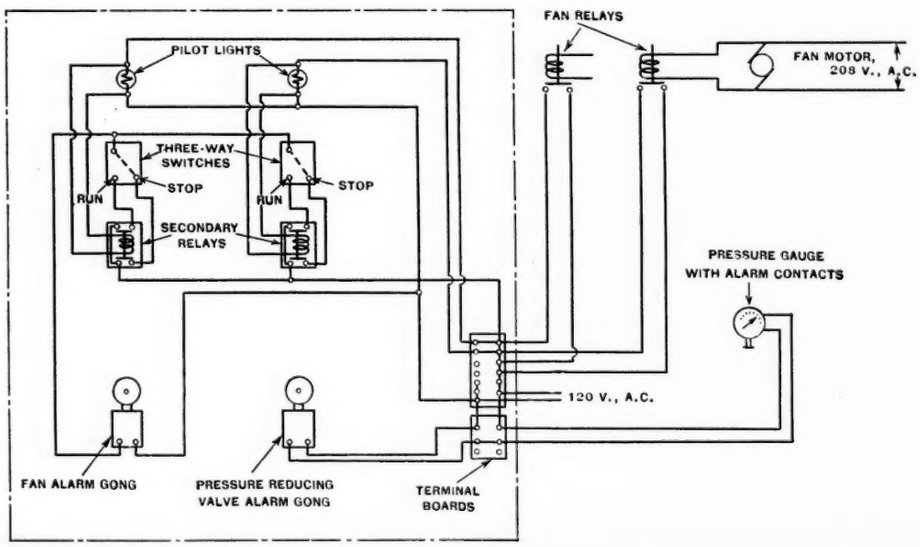


Fig. 4. Wiring diagram of the alarm system

maining lighted. When the motor is started, the fan relay opens the circuit which extinguishes the pilot light and lets the secondary relay drop, closing the bell circuit through the lower contacts. The engineer may then stop the ringing of the bell by throwing the switch to the "run" position. In this manner, the engineer is automatically and forcibly notified of the starting and stopping of each fan.

The alarm system for the steam pressure reducing valves consists of a gauge with electrical contacts located on the low-pressure side of each reducing valve. An individual gong operated by 120 volts, a.c., is provided for each valve and is so wired that the gong will ring when the pressure exceeds that for which the contacts are set. No switches are provided for these gongs in order that they may be stopped only by remedying the trouble causing the alarm. No alarm is provided to indicate low pressure, since the pressures will be varied by the operation of the controls.

Pressure gauges are provided on a central board to assist the engineer in the operation of the heating and ventilating system and to advise him of the pressures existing throughout the system. Electric indicating pressure gauges are used to indicate the pressures in steam lines on the upper levels, thereby eliminating trouble due to excessively long gauge lines and accumulations of condensation in them.

The gauges are flush mounted on a panel directly over the pilot lights, switches and the like for the alarm system. The panels are black marine-finished slate with chromium-plated rosettes. Mounting rings for gauges and the switch plates are also chromium-plated, as are the name plates designating the services of the various instruments. Each pilot light and the corresponding switch is mounted on a common plate with the "run" and "stop" positions of the switch and the fan number and location engraved in the plate with black-filled letters.

As is customary in all commercial buildings of the type of Building One, every effort has been made thoroughly to isolate the fans, motors, pumps and other moving equipment in order to prevent the transmission of vibration to the building structure with resultant noise in adjacent rentable spaces. The radio broadcasting studios introduced the problem of additional isolation of piping and ductwork and special bracing of all ductwork adjacent to the studios in order completely to eliminate any noises which might affect the radio transmission. Accordingly, all piping passing the eleventh floor pipe gallery over the studios is supported by means of insulated hangers. These hangers are constructed so as to introduce a rubber cushion between the upper and lower parts of the hanger rods to eliminate metal-to-metal contact between the piping and the supporting floor slab. Ductwork passing through this same pipe gallery is isolated from the hangers by means of hair felt. In this manner, all possible interferences with radio broadcasting by noises generated within the heating and ventilating systems will be eliminated, and the radio public will receive programs without knowing of the existence of such a complex collection of equipment as the heating and ventilating system of so extensive a building must necessarily be.

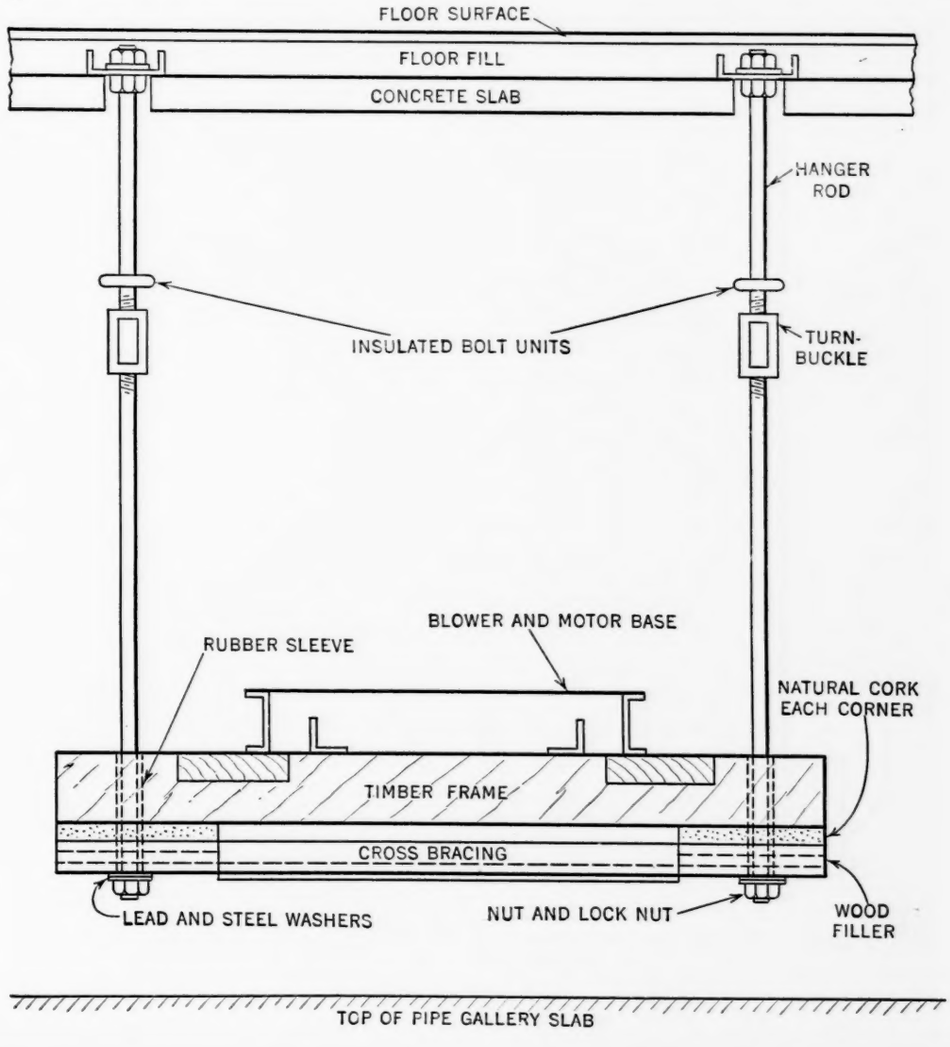


Fig. 5. Arrangement for isolating blowers from building structure

Making the R with a S

"Doc" White is the service engineer for a heating contractor operating in several cities. He is middle-aged, and possesses, among other desirable qualities, an even temperament, a logical mind, and perseverance, the result of which is thoroughness. Doc's particular hobby lies in ferreting out operating troubles in heating systems. For some time Doc has been planning to take on an assistant.

ON a chilly October morning, hurrying through his correspondence, Doc noticed that the usual seasonal trouble letters were arriving. He hastily sorted the letters, keeping those which had to do with the operation of heating systems, because these were often the most difficult and, consequently, the most interesting. The others he dispatched to his subordinates.

The telephone rang, and after the usual salutation Doc said, "All right, send him in." A moment later the office door opened and a young man about twenty-two years of age walked in, hat in hand. He was, apparently, a modest, earnest, willing and courteous gentleman.

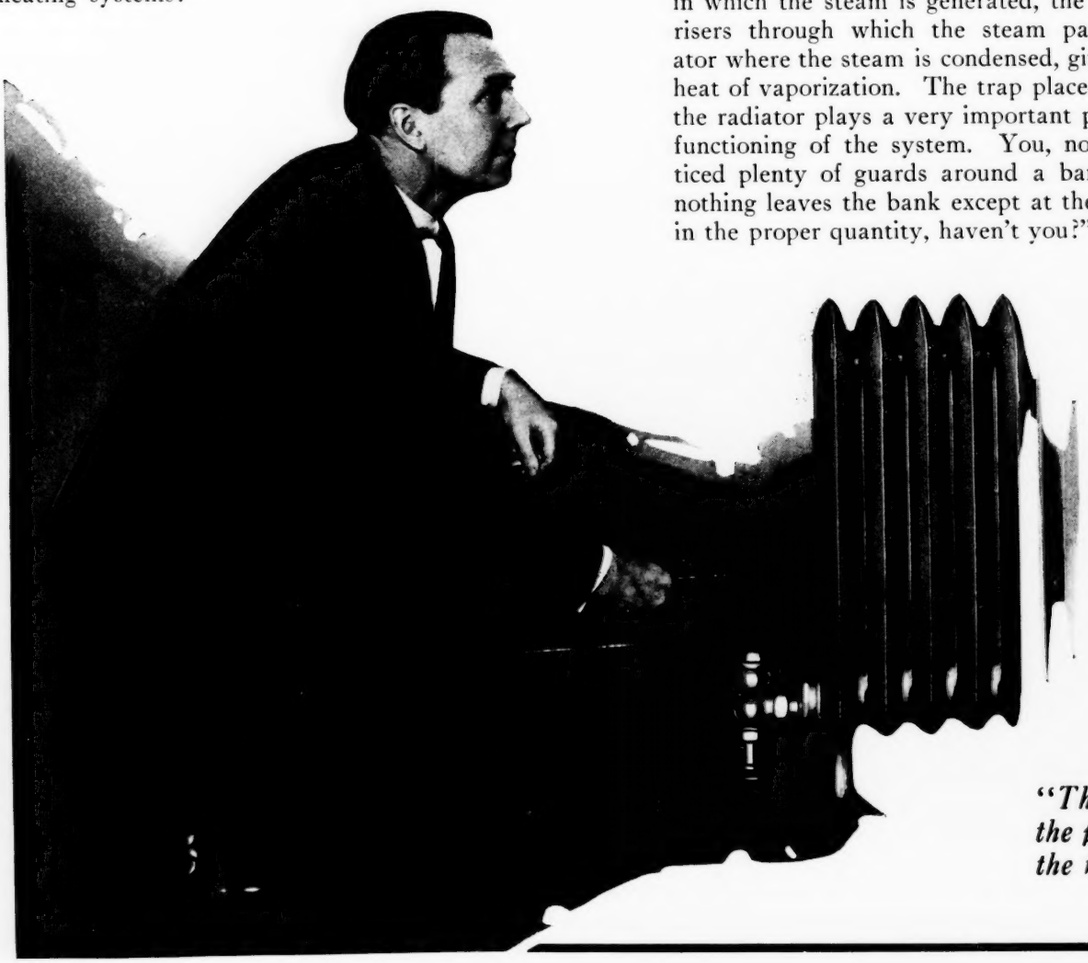
"My name is McKay, Mr. White. You recall that I mailed you my application a few days ago in response to your advertisement in the Help Wanted column."

"Glad to know you, Mr. McKay. Take off your coat and have a chair," he said, as he reached for some papers on his desk. "I am looking for a young man whom I can train as an assistant, and judging from your qualifications, you will fill the bill provided it is to your liking. Have you had any experience with heating systems?"

"No, sir, I haven't, Mr. White. My schooling has given me the principles of steam heating but, so far, I have had no practical experience, and I firmly believe that theory with no practice is just as bad as practice without theory. A combination of both, I believe, is the happy medium."

"Wisely spoken, my lad," said Doc, blossoming out with one of his broad smiles. "I have had a little of both and I still have plenty to learn. Our duties in this department are to follow up all trouble calls on heating systems, just as a doctor answers a sick call. We have to diagnose the trouble and prescribe the remedy. The unfortunate part of it is that we can't bury our mistakes."

Doc pointed to a chart hanging on the wall. "This sketch shows diagrammatically an elementary vacuum heating system," said Doc, "stripped of all the gadgets which are not absolutely essential to the system in its most simple form. The system consists of the boiler, in which the steam is generated, the steam mains and risers through which the steam passes to the radiator where the steam is condensed, giving up the latent heat of vaporization. The trap placed on the outlet of the radiator plays a very important part in the correct functioning of the system. You, no doubt, have noticed plenty of guards around a bank to insure that nothing leaves the bank except at the proper time and in the proper quantity, haven't you?"



"The trap guards against the passage of B.t.u.'s in the form of steam.

Rounds SERVICE Man

By
V. D. Milliken

"Yes, I have," assured McKay.

"Well, every trap on a radiator is guarding the material which leaves the radiator just as the bank guard does. The trap guards against the passage of B.t.u.'s in the form of steam. The trap will open and allow comparatively cool air, vapors and condensate to pass, but when steam heavily laden with B.t.u.'s attempts to pass, the trap shuts like a clam. Of course, if you were to throw dirt in the bank guard's eye, you could walk away with a lot of money that shouldn't pass the guard. The same applies to a trap. You can't expect them to be up to snuff if they have dirt on the seat of the valve because steam will then pass which is not only a waste of money, but a detriment to the proper operation of the system as a whole. So much for traps for the present.

"The air, vapors and condensate expelled by the trap," he continued, "flow through the return risers and return main to the vacuum pump where the air and vapors are separated from the condensate. The air and vapors are vented to the atmosphere and the condensate is discharged to the boiler. Simple isn't it?"

"That certainly is interesting and seems simple enough the way you describe it, Mr. White," replied McKay, "but what is the advantage of a vacuum system over a gravity system?"

"There are several advantages," replied Doc. "Looking at it from the point of view of the tenants, the vacuum heating system does not liberate foul odors, vapors or water into the rooms or on the floors and decorations, accompanied by noise. Secondly, the heating-up period in the morning consumes less time because the vacuum pump removes the air quickly and hastens the circulation of steam. Thirdly, from the owner's point of view, the vacuum heating system is kind to its owner's pocketbook, because such a system derives the full benefit of the latent heat of vaporization from the steam at the radiator where it is needed, not in the return risers and mains located in the basement. You generally want your cellar as cool as possible, for obvious reasons."

"I didn't know there were so many advantages," exclaimed McKay with a smile.

"Oh, that isn't all," replied Doc. "Fourthly, a vacuum pump eliminates the necessity of expensive boiler pits which are often required on a gravity job in order to get gravity flow to the boiler. On a vacuum heating system, radiators may be placed below the water line in the boiler. Another important advantage is that the return risers and mains may be decreased in size with the resultant saving in installation cost."

"It seems to me, Mr. White," said McKay seriously, "that the owner of a building who selects a gravity system really pays for a vacuum system, only he doesn't get the traps and the vacuum pump; that is, considering the annoyance of odor, noise, and damage, the slow circulation, the uneconomical distribution of heat, and the costly installation."

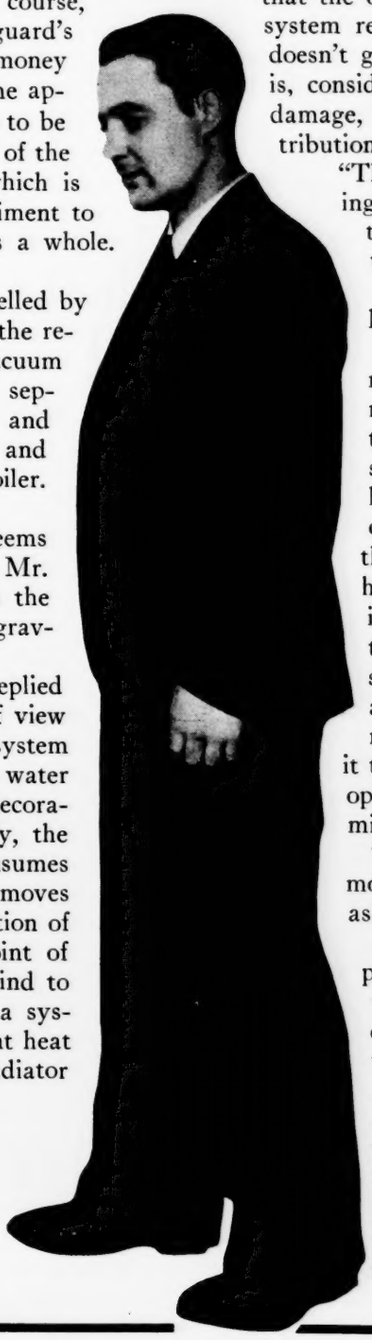
"That depends on the size and type of building," replied Doc. "You are doing some thinking, however, and you will eliminate the bungalow in the process, I'm sure."

"How is the equipment selected for a heating system?" inquired McKay.

"The equipment is specified by the engineer responsible for the mechanical equipment. He should, and usually does, mention several makes of the equipment he is selecting. It is to his advantage, in the long run, to have an open mind to all first-class equipment. If I were responsible for the selection of equipment for a vacuum heating system, I would select a boiler having a large reserve capacity. I would select traps for their performance on the job, for simplicity and ruggedness of design, for the ability of the trap to remain free of sediment, scale or core sand which might cause it to leak or to remain closed when it should open and, lastly, for its accessibility to permit cleaning and repairing."

"I suppose the vacuum pump requires the most careful selection, doesn't it?" McKay asked.

"Not necessarily," replied Doc. "Vacuum pumps are now made quite fool proof and they will all work if you give them a chance. If you select a vacuum pump in the same manner that you do an automobile, you won't go far wrong. What you are interested in is performance. You want your car to perform economically, to be free from expensive adjustments and repairs, and to give you equal performance tomorrow, next year, or several years from now. It should be sturdy and capable of



It will allow air and condensate to pass, but closes like a clam against steam."

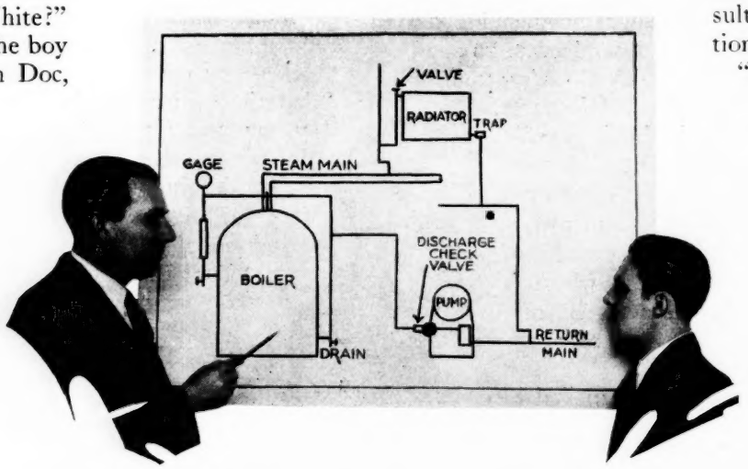
equal performance under any reasonable temperature condition. The safest way to select an automobile is to request a demonstration under actual operating conditions, and by comparison with other makes. Don't select a car merely for the paint job, or because a salesman told you that his car was the best and all the other makes were no good. And don't forget that what is worth knocking is worth investigating."

"I should imagine that valves are rather important too, because they must be tight and must not allow leakage of air into the return line," said McKay.

"Yes, indeed," replied Doc. "The valves used on the steam side of the system must be tight too, because they may leak steam when pressure is on the boiler, or they may admit air when there is a vacuum."

"How about the installation of equipment, Mr. White?"

"The steamfitter is the boy who does that," began Doc,



"This shows an elementary vacuum heating system"

"and he certainly deserves credit for installing all the gadgets into the small crannies which are left when everything else is in place. It takes plenty of room to swing a Stillson. It is very essential that everything be tight because leakage of air into the system is a detriment to proper operation. The fitter, therefore, is very careful to make all joints tight. Naturally, the boiler is tight, all the valves on the steam header and risers, the radiator valves, and the radiators must be tight. It is especially important to the operation of the vacuum pump that the whole of the return system, including the vacuum pump, is free from leakage because a leakage of air into the system at any point reduces the effectiveness of the system.

"Since the vacuum pump is the only piece of moving machinery on the average vacuum heating system which has a hand-fired boiler and which discharges the condensate directly to the boiler, we will discuss it in particular. I am referring only to rotary-type vacuum and boiler feed pumps, either motor or steam turbine driven. All manufacturers of such pumps issue an installation booklet or drawing, describing the method of installing and the precautions to be taken. Some pumps must be carefully leveled to prevent warping the base, which might cause misalignment, or result in binding of the rotating parts. Other pumps do not require this, due to differences in construction. It is, therefore, necessary to follow carefully the printed instructions issued by the manufacturer. Cork or rubber isolation pads may be used without fear under pumps which do not require precise alignment.

"Incidentally, rubber pads are very effective. Four rubber pads under the four corners of the pump, having a total area sufficient to give a compression of approximately 35 lb. per sq. in., when carrying the weight of the pump, give excellent results. Compression rubber ½ in. thick is sufficient. Cork pads, made of natural cork, are also very effective, although such pads are naturally of greater thickness. A load of approximately 35 lb. per sq. in. gives satisfactory results with cork also. The common mistake, when installing isolation pads or foundations, is to use too much rubber or cork. If too much is used, the proper compression is not obtained and therefore the results are *little* or *no* isolation."

"Do you obtain the 35 lb. compression by pulling down on the foundation bolts, or do you consider only the weight of the pump?" asked McKay.

"The weight of the pump only is considered," replied Doc. "As a matter of fact, foundation bolts are not absolutely essential. The weight of the vacuum pump is sufficient to prevent its walking away from you."

"What precautions should be taken when a system is first put into operation?" inquired McKay.

"The first step is thoroughly to clean the system," Doc replied. "There are several good compounds on the market which are made to remove oil, grease, rust, scale, and core sand from the boiler, piping and radiation. The best plan is to steam up and flush out as much foreign matter as possible. Then add the compound to the boiler which is kept simmering for several hours according to directions recommended by the manufacturers of the compound. The boiler is then steamed up and fired as for regular operation for several days. The compound removes and absorbs the oil, grease, scale and dirt which settles to the bottom of the boiler where it may be drained off.

While this cleaning operation is going on, the condensate should be wasted to the sewer, and the water level in the boiler should be watched carefully. When thoroughly cleaned, the boiler must be flushed before fresh water is added. The condensate should drain to

the sewer for about two weeks to remove the majority of the foreign matter from the system. Scale and core sand are abrasive materials and will cause excessive wear to some vacuum pumps. The traps should be cleaned thoroughly to remove all foreign matter. Before starting the pump, the oil wells and grease cups on the motor and pump should be filled, the pump should be primed with water, and the current should be checked to be sure that it corresponds to the current for which the motor is wound. Turn the pump over by hand to be sure that it rotates freely and start the pump."

"Then it's all over but the shouting," said McKay.

"The fireworks then begin and, believe me, there is plenty of shouting," was Doc's response. "Do you think you will like this kind of work?"

"Yes, but I don't know anything about the troubles encountered and how to cure them," replied McKay.

"We will come to that when we get out on some of the jobs on which I have reports," said Doc, reaching for the several letters on his desk, "but first you must understand the vacuum heating system in order to remedy its faults. Judging from these reports, we will get quite a variety of troubles as we follow them up, and I will explain the causes and how to remedy them. We will start out in a few minutes, and while you are waiting, suppose you study that chart and get the elementary vacuum heating system thoroughly fixed in your mind."

Next month, Doc takes McKay on his first real job —a building where the superintendent reports that the pump will pull only four or five inches of vacuum. Mac learns a little more about vacuum heating and finds that the first logical deduction is not always the correct one.

Humidity in the Pressroom

IN our experiments and investigations of humidity control in the pressroom, we have been faced not only with the difficulty of maintaining a uniform humidity continuously in the room as a whole, but also of maintaining the same relative humidity in all parts of the room at the same time. We found that several factors which formerly were taken as a matter of course had to be controlled if the desired uniformity was to be obtained. These factors were for the most part those which affected the temperature, for as the relative humidity varies inversely as the temperatures, any local conditions which developed variations of this sort tended to prevent this uniformity.

One of the most obvious of these disturbing factors was the gas flame on the delivery of the press. This not only raised the temperature of the air in its immediate vicinity, but it warmed the paper as it was delivered from the press, and thus the pile of printed sheets had a different condition of humidity when delivered than before, and this variation had an important effect when printing process color work. As the humidity control was installed for the purpose of maintaining uniform conditions in the paper, the use of the gas flame was tending to neutralize the good that had been accomplished.

The gas flame, which is in quite general use on presses, is primarily for the purpose of preventing offset on printed sheets, in eliminating static electricity, and in hastening the drying of the ink. The first difficulty can be overcome by keeping the humidity up to 50%, so it was necessary to find some means of aiding the ink to accomplish its initial "set" if the gas was to be given up.

An investigation of the drying of ink shows that, as the moisture in it consists chiefly of linseed oil, it dries partly by absorption (according to the nature of the paper) to only a small extent, by evaporation, and for the most part by oxidation. In other words, it needs oxygen much more than it does heat. If a press could be run slowly enough or had a delivery long enough, so that a sufficient time elapsed between the printing of the film of ink on one sheet and the time when the next sheet was laid on top of it, there would be no difficulty from offset. But with presses running over 1,000 sheets an hour, this period of exposure to the air is not long enough to accomplish this, especially if the form is heavy and an enameled paper is used. It was, then, obviously necessary to supply additional oxygen without reducing the speed of the press, if offset was to be avoided.

To meet this we first, in place of the gas flame, installed devices called "ink setters," which by use of electricity at high voltage added ozone to the air and thus made the oxygen more active in oxidizing the ink. This installation resulted in a marked improvement in the drying of the printed sheets.

At the same time we succeeded in prolonging the time of exposure to the air by using a box on the delivery for receiving the sheets and by projecting a jet of air under the sheet as it fell into the box. By adjusting the boxes to a size that fitted the sheet closely, the air was retained under the sheet for a considerably longer time, depending somewhat on the weight of the paper. This additional time extended the oxidizing effect just as would an equal amount of time on the delivery. The air device was used together with the ink setter.

The result was that the sheets were delivered without offsetting, except for heavy halftone forms, which naturally would require slipsheeting anyway; and what was more important, they were delivered without change in temperature, and, consequently, without change in their relative humidity. Another important result was that the pressman standing at the delivery end of the press watching the sheets was not subjected to the heat and fumes of the gas flames.

In doing away with the gas we have eliminated an important factor that interfered with maintaining uniform humidity, we can hold closer register, and at the same time we have made the pressroom a more comfortable and healthy place in which to work.—*Carl W. Davis, in an address at the Third Conference of Technical Experts in the Printing Industry, March 14-15, New York.*

Regenerative Cooling for Hot Dry Climates

By K. P. BRACE

IN certain localities, such as Arizona, New Mexico, and parts of Texas, Oklahoma, and California, where a hot dry climate generally prevails, there exists a relatively large differential between the outside dry bulb and wet bulb temperatures. This temperature difference represents a potential source of energy, just as the difference in temperature between the flame under a boiler and the relatively cool condensing water does.

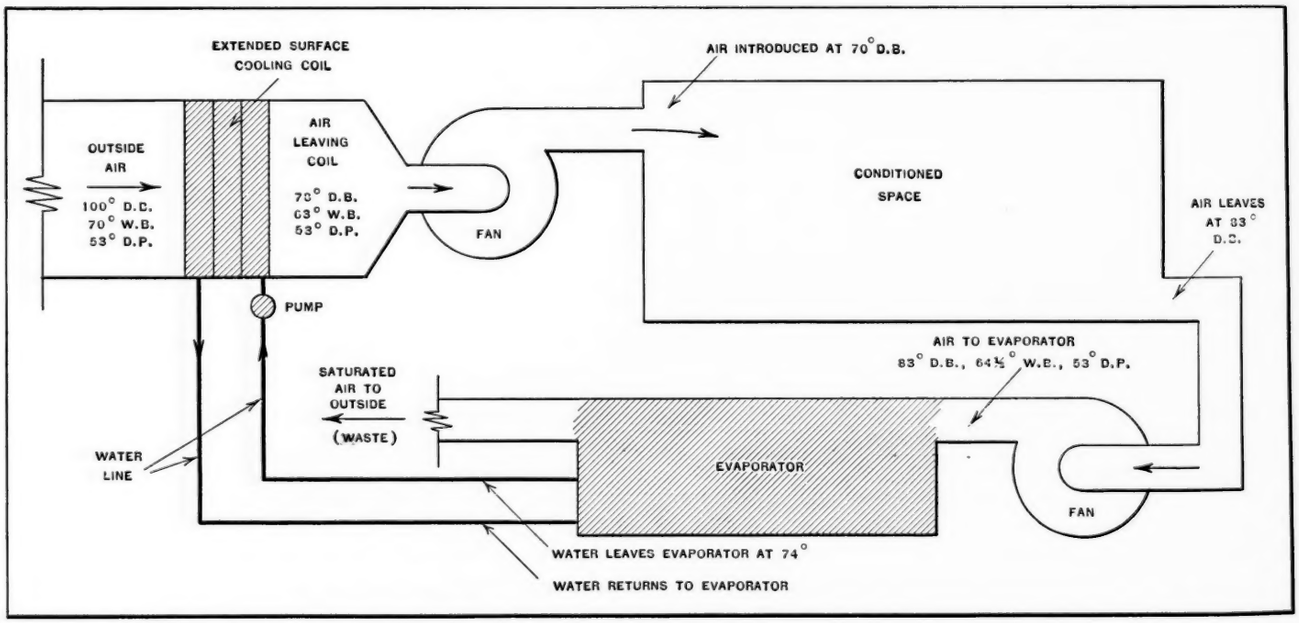
The author has been connected with experimental work investigating the possibilities of applying this idea to actual cooling systems. Some of the results from one method tried are reported here.

A method of space cooling which utilizes the energy available due to the difference between the dry and wet bulb thermometers. An evaporator, pump, cooling coil and piping constitute the necessary equipment. The method differs from the usual idea of washing the air before introduction into the room, in that this system saturates the air after being exhausted from the conditioned space.

The accompanying drawing shows one means of effecting cooling by this method. Outside air is passed through an extended surface cooling coil supplied with cool water from the evaporator. Cooled air is forced by a fan into the space to be conditioned, where it picks up heat and is exhausted into the evaporator. Here it becomes saturated with water vapor and is discharged as waste to the outside.

In order to explain the cycle more clearly, let us assume that we have a cooling coil which will cool air to within 4° of the entering temperature of the cooled water passed through it, and that the evaporator will cool water to within 4° of the entering wet bulb temperature of the air passed through it. Starting around the cycle, assume that we have water available at not more than 4° above the outside wet bulb temperature. The outside air conditions are 100° dry bulb and 70° wet bulb, and the water temperature at the start, 74°. The air will be cooled in passing through the coil from 100° to 78° dry bulb. This 78° air is supplied to the conditioned space, where it picks up heat so that its temperature rises to 83°. The air passes to the evaporator at 83° dry bulb and 64½° wet bulb. We are assuming that the dew-point is remaining constant throughout the cycle, as would be the case where the moisture pickup in the conditioned space is quite small (such as in a lightly occupied room).

The ideal action in the evaporator would be that of adiabatic saturation, the air becoming saturated at constant total heat. In practice, however, the action in the evaporator approaches saturation along the line of constant total heat and the dry bulb temperature of the air is dropped. Since, however, relatively no heat is added from outside sources, the immediate tendency of



Schematic drawing of "regenerative" system of cooling

the air temperature is to approach equalization with that of the water, and the heat required to evaporate the water will be taken from the water itself. Thus, the temperature of the water will be lowered, approaching the wet bulb temperature of the air.

The drawing shows the results obtained in the first cycle. As the water is again recirculated its temperature drops to 68°, and finally to 66½°, where it has approached the wet bulb temperature as closely as is possible with the evaporator. Consequently, the temperature of the air leaving the cooling coil will drop successively to 72° and, finally, to 70½°, and the dry bulb temperature of the air leaving the conditioned space will drop from 83° to 76° and, finally, to 74°. With these last given temperatures the system will continue to operate.

Using a regenerative cooling unit consisting of an eight-row extended-surface cooling coil and a two-stage evaporator, it was possible under all entering conditions to reduce the dry bulb temperature leaving the coils to within 4° to 5° of the entering wet bulb temperature. For example, when outside conditions were 95° dry bulb and 68° wet bulb, it was possible to cool the air to 73°. When entering conditions were 100° dry bulb and 70° wet bulb it was possible to cool the entering air to 75°.

By adding more surface to the cooling coil and to the water evaporator it would, of course, be possible to cool the entering air to the wet bulb temperature, or even lower, since the ultimate limit of drop is the dew point temperature and not, as some suppose, the wet bulb temperature.

Operation and Maintenance of Mechanical Oil Burners

IN view of the increased number of installations of oil-burning equipment made during the past several years, a few hints on operation and maintenance may prove beneficial to owners and operators of this apparatus. This information is intended to apply more to the larger type of oil-burning installations, than to those in private homes, using lighter grades of oil.

In the writer's opinion, fully 90% of all operating difficulties are due to improper atomization. The primary function of the oil burner, whether of the steam or mechanical air atomizing type, is to break up the oil into fine particles that will readily mix with air supplied in correct proportion, so as to be in a partially vaporized state at the point of combustion. When this is carried out, efficiency will be high, and carbonization will be minimized.

For the best results, the fuel oil should be delivered to the burners at a constant temperature. This may be controlled by a temperature regulator varying the amount of steam to the heating coil to suit the grade of oil, and the demand. No one temperature can be recommended for all grades of oil, and adjustment of the regulator may be necessary to allow for variations in each shipment of oil received. If the temperature is too high, an orange or yellowish flame will result, accompanied by black smoke. The fire in this case will usually burn in blasts or puffs, and may become so unstable as to be extinguished, presenting the hazard of a flareback. If the temperature is not high enough, on the other hand, ignition will be difficult, and the fire will tend to go out on low boiler loads, when the oil pressure is low.

Care should be exercised in the selection of the size of tip used in the burner. A too small tip may carbonize on overloading, and it will often be impossible to maintain a constant steam pressure in the boiler under varying load. When the tip used is too large, for the average steam load carried, operation will be unsteady, with the oil pressure regulator remaining closed and the oil flowing through the low load by-pass the greater part of the time. This will also result in a lowered operating efficiency.

With the type of burner having a rotating bowl, the "gun" is generally demountable. The following rules of procedure should be observed when shutting down this type of burner: Shut off the oil first. After several minutes, with the air flowing through to clean the feed tube and bowl, the air supply should be shut off. The burner should be removed immediately from its mounting to prevent its being overheated.

Burners should be cleaned at least once each day, and as soon as possible after the burner is removed. Kerosene may be used for cleaning, but the burner should not be allowed to soak during the entire time it is out of service. Excess kerosene should be drained out, and a good grade of light lubricating oil should be applied to all moving parts, and parts that might rust. Care should be taken in handling this type of burner, to avoid nicking or scratching the edge of the bowl, as such distortions will cause a spray of wet vapor from one side of the bowl, resulting in excess carbon formation, and uneven furnace temperature. Precaution must be taken against enlarging the hole in the tip with a wire or other tool, while cleaning.

Carbon formation in small amounts on the furnace bottom is not an indication of trouble. It should be broken up with a bar, and removed or pushed forward and burned up, because an accumulation under the burner may cause overheating of moving parts. If it forms in excessive amounts, it is an indication of improper atomization, probably due to one of the factors previously mentioned.

Should the operator notice at any time that the fire is out with the oil turned on, he should immediately close off the oil supply, open all dampers, and increase air flow to a maximum. He should not attempt to relight the burner before two minutes have elapsed, and never until the furnace has entirely cleared of all smoke, haze, or vapor. When the fire goes out with the oil turned on, it will be accompanied by a heavy, yellowish smoke from the stack. The burner should always be ignited by a torch, or some internal igniter, and never from the hot furnace walls.—*Harry M. Spring.*

Air Binding in a Vacuum System

By the TROUBLE ENGINEER

The Problem: Gravity system converted to vacuum system became air bound, and failed to return water to boiler when pressure rose to 4 lb.

A SINGLE pipe gravity heating system which had been installed ten years previously in a four-story apartment building, failed to operate to the satisfaction of the owner who called upon a contractor to correct the trouble. Pounding, air binding, sluggish circulation, and retention of condensation by the radiators, seemed to be causing the difficulty. After a thorough check-up it was decided to convert the installation into a vacuum system.

Radiation seemed ample but was of the old steam type, and the first step was to remove the air valves and plug the openings. After that the 2 in. plugs in the return openings were removed, the openings bushed to ½ in., and ½ in. vacuum traps were installed on each radiator return. The traps were then connected to a return line in the basement. The steam supply main was located at the ceiling in the basement, and each riser was dripped into the return line. A ½ in. vacuum trap was installed on each riser drip, together with a 1 in. vacuum trap on the drips of the main. The vacuum pump was placed in a pit in order to accommodate the return line located below the floor of the basement. The layout as connected is shown in Fig. 1, and seemed ready to operate.

When the plant was started, however, the heating contractor discovered that while the system would function well for about 45 minutes to an hour, after that time some radiators on the top floor failed to heat up, followed by others on the third, second and first floors. Finally, after two hours, the entire system failed with some radiators cold, some warm and others warm in only a few sections. An examination of the traps, as well as of the vacuum pump, failed to reveal anything wrong at these points.

As the trouble could not be found by inspection, test gauges were applied and the plant was again started. The gauges showed 1½ lb. pressure at the main, 1 lb. at the top floor, and 6 in. of vacuum at the pump, with all radiators hot. After a half hour, the gauges read 2 lb. steam pressure, 6 in. of vacuum, with all radiators still hot. After one hour the readings were 3 lb. steam and 4 in. of vacuum. Some radiators on the fourth and third floors were cold. After 1½ hr. the gauges showed 4 lb. of steam and 1 in. vacuum, and all the radiators were cold.

It was thought that possibly the 1 in. trap on the main drip was not taking care of the condensation and a by-pass was arranged, as shown in Fig. 2. This, however, did not materially help matters, merely serving to remove the condensation a little faster.

After spending over a week on the job, during which a number of suggestions were tried out, the heating contractor called for help and the Trouble Engineer went over the entire job with the contractor, questioning him on the action of the system. His answers showed that he had really run out of ideas.

A test was arranged for the next morning, which showed the same pressure and vacuum readings as listed previously. A thorough inspection revealed the fact that the by-pass around the main drip trap was left open, thus discharging steam into the vacuum return. This was corrected, but it resulted in very little improvement. Several riser drip traps were not functioning and these were opened and found to be full of dirt. After cleaning the traps, no better results were obtained. The entire system seemed to be air-bound, but the cause was a mystery.

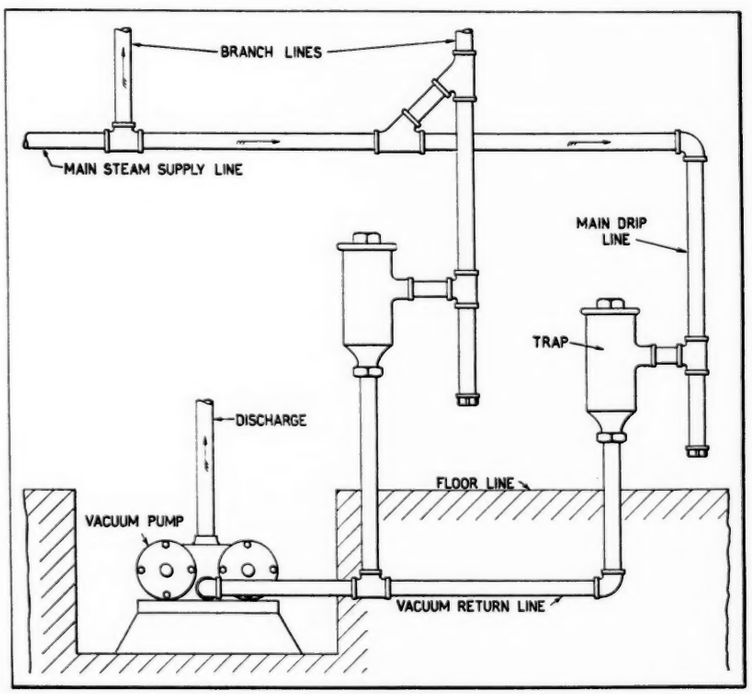


Fig. 1

During a thorough check-up of all the equipment, we came to the discharge of the vacuum pump. A tee had been provided about 10 in. above the pump from which branched a 2 in. discharge to the boiler, and also a 1 in. pipe which led straight upward through the ceiling of the room (see Fig. 3). The branch to the boiler carried a shut-off valve and a

check valve. Line A, running upward, we were told, extended through the roof, and was an air vent only. We doubted this, however, and upon further investigation on the second floor, it was found that an air trap was installed 7 ft. 2 in. above the pump.

This air trap was causing all the trouble, but it was necessary because there was no receiving tank, and the vacuum pump handled both air and water. The trap, shown in Fig. 3, discharged to the atmosphere as shown. It was placed in this position to relieve the air from the return line. It failed to do this, however, because the condensation discharged by the pump, as indicated by arrow, lifted the float of the air trap, thus closing the air port and pocketing the air in the vacuum return line.

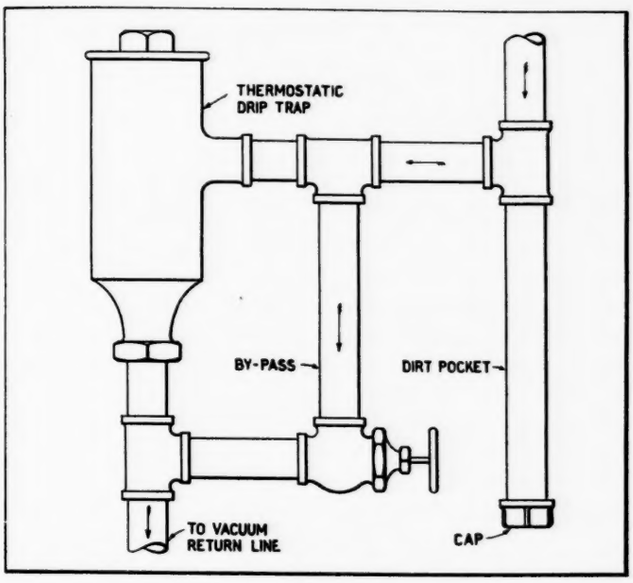


Fig. 2

When the boiler pressure reached 4 lb. the static head between the air trap and the pump was not great enough to force the water into the boiler through the check valve, due to the fact that the boiler water line was 3 ft. 8 in. above the discharge from the vacuum pump. This caused air binding throughout the system. The air trap was removed and placed 18 ft. above the vacuum pump and the air discharged from the trap was carried through the roof. In this position a sufficient water column could be carried to force the water into the boiler, leaving air space above the water column for the air to escape through the air trap.

The size of the vertical discharge line A was increased to 2 in. in order to forestall the raising of the water by the air traveling upward, as was the case in the 1 in. line originally installed.

The reader will note that the gear type vacuum pump used did not have a receiving tank or air separator, the discharge being connected directly to the air trap. The air from the vacuum pump carried slugs of water into the 1 in. air trap which lifted the float and closed the air port. As the air port was only a ¼ in. opening, it was not large enough to permit the air to escape when the float momentarily dropped between slugs of water carried upward in the 1 in. pipe as explained. Under these circumstances, condensation was unable to enter the boiler properly and the boiler water line dropped as soon as the pressure increased to 4 lb.

The contractor contended that the air discharged should go upward through the water, and would escape from the trap as long as the trap was 5 ft. or 6 ft. above the pump. This argument did not hold good because the air carried slugs of water upward with it and this water was trapped by the steady upward flow of air in the 1 in. pipe. Occasionally, some air escaped from the air trap, but not enough to free the suction line entirely. As the pressure increased, the height of the water column increased also, because each pound of pressure is equal to 2.3 ft. of water. After the 2 in. pipe was installed, the area of the pipe was sufficient to allow air to escape without lifting the water column into the trap body. The 1 in. air trap was used in the new location, 18 ft. above the vacuum pump, and no further trouble was experienced.

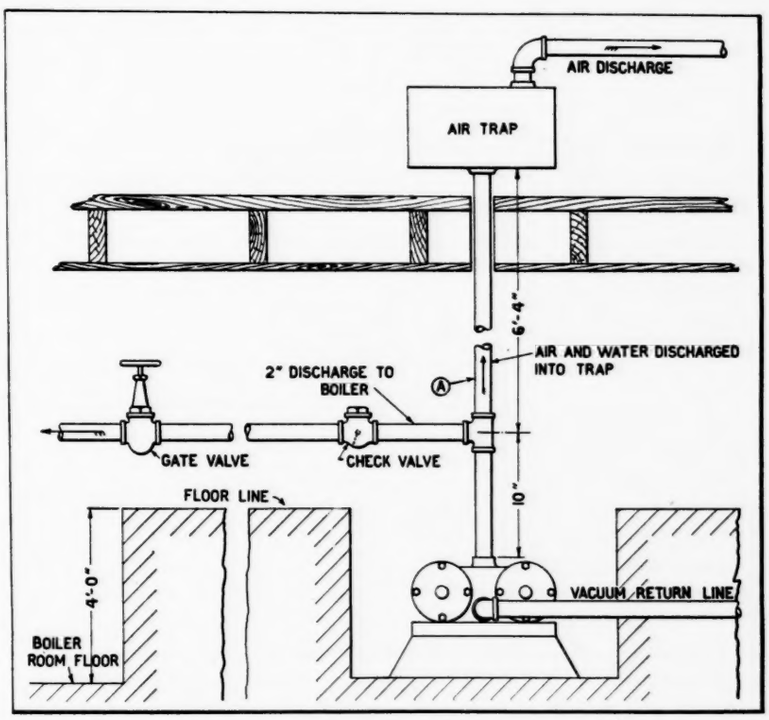


Fig. 3

Dehumidifying Air with Calcium Chloride‡

By S. B. HEATH†

THE object of this paper is to review some of the theoretical possibilities of calcium chloride for conditioning air, as indicated by the physical properties of calcium chloride solutions and solid, and then to describe the development of equipment built to apply these principles.

The pronounced hygroscopic and deliquescent nature of calcium chloride, which enables it to absorb moisture from the air and produce a solution, is the principal property which makes it so effective in dehumidifying air in houses. The hygroscopic character of calcium chloride solid and solutions is best shown in the form of a family of curves (Fig. 1) in which temperature is plotted against water vapor pressure for various percentages of calcium chloride in solution in water.

Temperatures in °F. are plotted on the horizontal axis and water vapor pressures in millimeters and inches of mercury on the vertical axis. Each curve represents a particular concentration of calcium chloride in water. The lower curve represents saturated solutions of calcium chloride solid in water, or in other words it represents the minimum vapor pressures which are in equilibrium with saturated calcium chloride solutions at the various temperatures.

Fig. 2 is the same as Fig. 1, with the addition of the percentage of relative humidity lines superimposed on it. The relative humidity lines, dotted, show the condition of air which is in equilibrium with various calcium chloride solutions at various temperatures. It is seen that the percentage calcium chloride and the percentage relative humidity lines are rather closely parallel over a considerable temperature range. Thus, a 40% calcium chloride solution is in approximate equilibrium with 40% relative humidity air throughout the temperature range of 55° to 110°. As an example of one use of these curves, we may point out that a 45% calcium chloride solution at 89° is in equilibrium with 29% relative humidity air at 89°, and has the same water vapor pressure at 89° that pure water has at 52°. Thus, by providing sufficient area of interface between moist air and 45% calcium chloride solution at 89° we can reduce the moisture content of the air

‡ Abstracted from a paper presented at the Air Conditioning Conference, Case School of Applied Science, Cleveland, March 17-19. Copyright 1932, by Dow Chemical Company.

† Research Engineer, Dow Chemical Company, Midland, Mich.

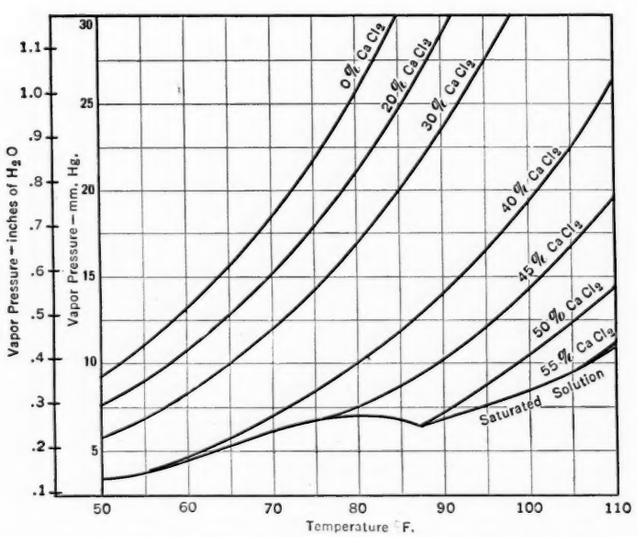


Fig. 1. Vapor pressure curves for calcium chloride and water

The best known method of dehumidifying air in connection with the air conditioning of buildings is to pass the air through a cold water spray, or over a cold surface, to reduce the temperature of the air below the saturation point, so that the moisture is eliminated.

A number of installations have been made using some hygroscopic material, such as silica gel, for extracting moisture from the air. The author here describes results which have been obtained in experimental work with calcium chloride as the dehumidifying agent.

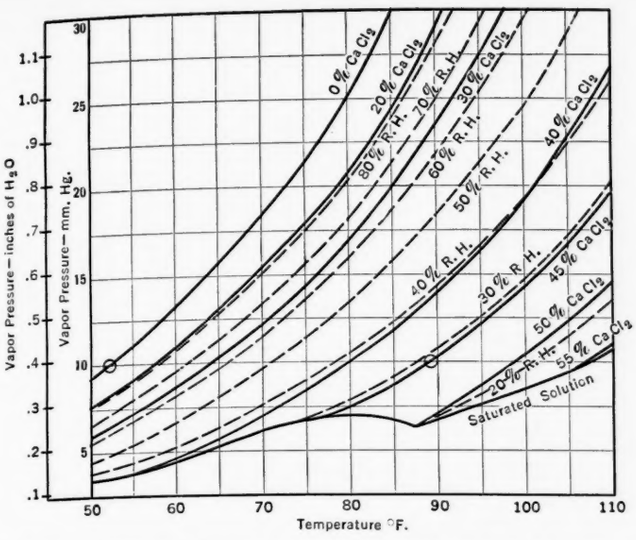


Fig. 2. Vapor pressure curves for calcium chloride and water and relative humidity curves

as low as would be possible with cold well water or refrigerated water at 52°.

The heat evolution due to the condensation of moisture must be removed to keep the temperature of the calcium chloride solution from rising. There is a small additional heat evolution due to the heat of solution of calcium chloride in water. This total heat is generated at a sufficiently high temperature level that it may be removed from the solution by cooling coils through which the house service water is passed. The concentration and hygroscopic power of the calcium chloride solution is maintained by having solid calcium present in the solution cycle which dissolves and offsets the diluting effect of the water condensed out of the air.

For the purpose of testing equipment which we have built to obtain design data necessary for the construction of air conditioning equipment using calcium chloride, we have equipped a test room approximately 24 ft. x 30 ft. which may be maintained at various summer weather conditions. A small insulated room 12 ft. square has been built in the center of the large room. The unit to be tested is located in the large room and delivers conditioned air into the small room. Ducts, orifice meters, and dampers are provided for proportioning the circulating and make-up air so that it is possible to deliver air of any desired condition to the unit to be tested. The air condition after passing through the test unit is measured in the small room. The facilities of this test room for testing air conditioning equipment using calcium chloride are available to manufacturers.

In the pactical application of calcium chloride for dehumidifying air, an extended surface for contacting the air and calcium chloride solution is required. At first glance, it appears that a simple way to get such a surface would be to spray the solution as a fine mist into the air and then remove the mist from the air with eliminators or filters as is done in air washing practice using water. If a small amount of water mist should pass the eliminators of an air washer using water, it is not particularly serious, as this mist will be completely evaporated on passing over the tempering coils, or on being mixed with warmer air. However, if any calcium chloride solution in the form of mist passes the spray eliminators or filters it will not be vaporized but will remain as mist in the air, and a portion of it would settle out on objects in the air conditioned room and be objectionable. For this reason we are skeptical of any methods of home dehumidification in which calcium chloride solutions are sprayed into the air. However, we are trying out a calcium chloride spray chamber followed by eliminators and filters of various types, but as yet we have no definite results on this equipment. We prefer to contact the air with an extended surface of calcium chloride solution, over which the air passes at moderate velocities, probably as high as 500 f.p.m., in order that no fine mist of calcium chloride solution will be introduced into the air.

For the purpose of obtaining design data we have built equipment which we also believe contains the elements of proper design for applying calcium chloride solutions in conditioning air for homes. This equipment is shown in Fig. 3.

The apparatus consists of a metal box which holds the calcium chloride solution. The shaft (A) supports 20 pieces of 36 in. diameter, 16 gauge steel discs (G) spaced at 1½ in. centers, which are rotated at 5¾ r.p.m. by means of the motor (B) and speed reducer (I). These discs are covered with a light turkish toweling cemented to the steel with sodium silicate solution. The discs dip into the calcium chloride solution to a depth of 12 in. and carry up a film of solution on their surface. The air enters through the duct (C) and passes through between the discs and out at (D). The drag of the discs on the solution causes a circulation of the solution over a baffle and back under it across water cooling coils located below the baffle, and then back across the top of the baffle. Commercial calcium chloride in the form of surface-dried flakes, as used in dustproofing roads, is fed in intermittently through a covered opening in amount sufficient to cover the floor of the box to a depth of approximately 6 in. As the solution volume increases, due to condensation of moisture, the solution overflows through the overflow pipe (H).

This machine has been operated in various ways to

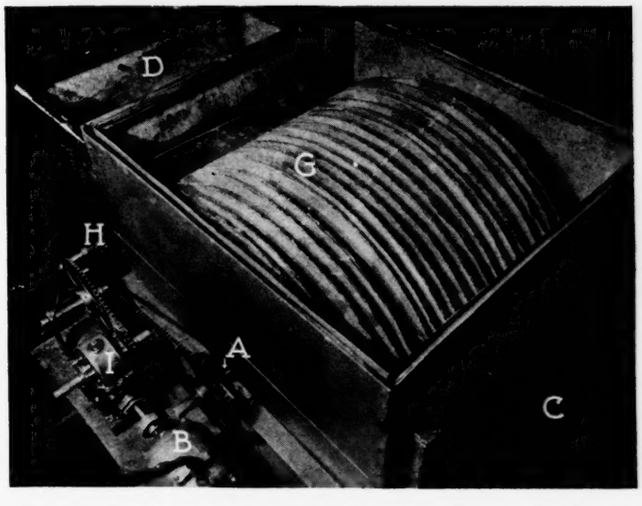


Fig. 3. Equipment used for applying calcium chloride to air conditioning in buildings

determine design data. The power required to rotate the discs at 6 r.p.m. was 280 watts. The overall heat transfer coefficient from the solution to the water in the cooling coils is 60 B.t.u. per sq. ft. of external coil surface per hour per °F. This coefficient is obtained with the discs revolving at 6 r.p.m. and with a water velocity in the coils of about 4 ft. per second. The heat exchange coefficient between the air and the solution varies with both the air velocity and the vapor pressure difference between the air and the solution. This heat transfer coefficient may be calculated in the same way in which the heat transfer coefficient from moist air to colder water would be calculated.[1]

Fig. 4 indicates the method of calculating surface areas required to perform a given amount of work. The surface areas to be calculated are the wetted solution surface required to exchange the heat and moisture from air to solution, and the cooling coil surface required to exchange the heat from the solution to the cooling water. In calculating the moisture exchange area required, the log mean vapor pressure difference between the air and the calcium chloride solution is used in a similar manner to which the log mean temperature difference is used in a heat transfer calculation.

The use of revolving discs partially submerged in calcium chloride solution has many advantages. The discs may be spaced at close centers, say ½ in., giving a very large wetted surface in a relatively small box. The rotation of the discs acts as a low head pump to circulate the solution over the cooling coils. The film of solution on the surface of the discs is changed so often that its temperature is probably very close to that of the body of the solution. In the calculation of the moisture exchange coefficients we used the vapor pressure of the solution at the temperature of the solution in the box. All of the solution in the box was at uniform temperature as nearly as we could measure.

For the purpose of obtaining a clearer understanding of the economics of air conditioning processes employ-

[1] The author's chart showing the moisture exchange coefficient vs. air velocity is not shown here. However, the relationship closely followed the curve $K = 0.43V$, where K = gr. of water per hr. per sq. ft. wetted surface per mm. Hg. vapor pressure difference, and V = air velocity in f.p.m. The relationship was shown to hold between V = 100 and V = 280, with discs at 1½ in. centers.

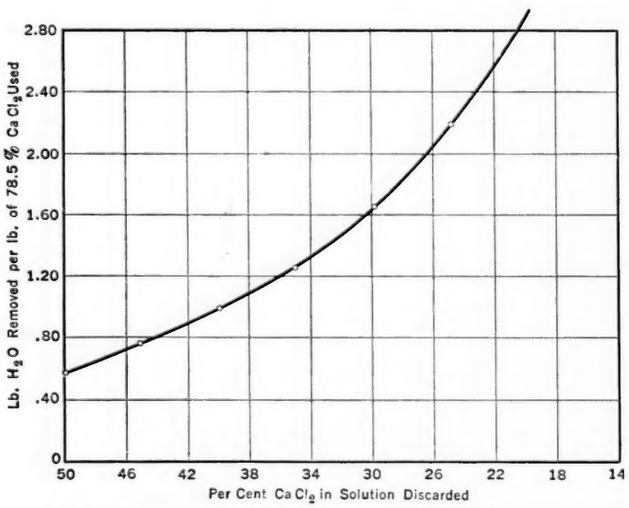


Fig. 5. Water removed per pound of 78.5% calcium chloride used versus per cent calcium chloride in solution discarded

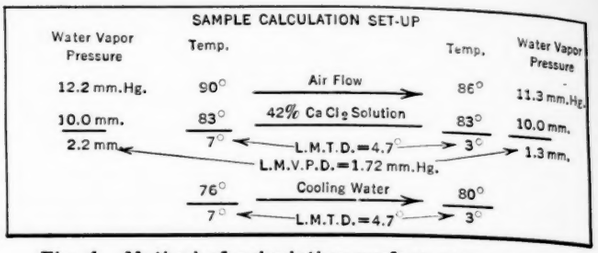


Fig. 4. Method of calculating surface areas required

ing calcium chloride, we have compared the cost of ice with the cost of cooling water for removing sensible heat from air. We have also compared the cost of ice with the cost of calcium chloride plus cooling water for removing latent heat from the air. These costs are calculated on the unit basis of 1000 B.t.u. heat removed from the air.

The premises for these cost estimates are as follows:

1. Ice delivered into house cooling equipment at $4 per ton. Melted ice discarded to sewer at 50° water temperature.
2. 78.5% calcium chloride delivered to dehumidifier equipment at $34 per ton. Calcium chloride solution discarded to sewer at 38% calcium chloride.
3. Cooling water available at 10 cents per 1000 gal., and a 4° rise in cooling water temperature realized before it is run to waste.

The calculations are as follows:

Cost of removing 1000 B.t.u. sensible heat from air.

With Ice

$$\frac{1000 \text{ B.t.u.}}{144 + 18} = 6.17 \text{ lb. ice}$$

6.17 lb. ice at $4 per ton (.2 cents per lb.) = 1.234 cents

With Cooling Water

$$\frac{1000 \text{ B.t.u.}}{4° \text{ rise}} = 250 \text{ lb. cooling water} = 30 \text{ gal.}$$

30 gal. water at 10 cents per 1000 gal. = .30 cents

Cost of removing 1000 B.t.u. latent heat from air.

With Ice

$$\frac{1000 \text{ B.t.u.}}{144 + 18} = 6.17 \text{ lb. ice}$$

6.17 lb. ice at $4 per ton (.2 cents per lb.) = 1.234 cents.

With 78.5% $CaCl_2$ and cooling water

$$\frac{1000}{1045 \text{ B.t.u.} = \text{sensible heat at } 85°} = 0.957 \text{ lb. water to be removed.}$$

$$\frac{0.957 \text{ lb. water}}{1.065 \text{ lb. water removed per lb. of 78.5\% } CaCl_2 \text{ used when 38\% } CaCl_2 \text{ is discarded}} = 0.90 \text{ lb. 78.5\% } CaCl_2 \text{ required.}$$

0.90 × 0.785 × 135 B.t.u. per lb. $CaCl_2$ = 95.4 B.t.u. heat of solution of $CaCl_2$ used.

$$\frac{1000 \text{ B.t.u. from air} + 95.4 \text{ B.t.u. from } CaCl_2}{4° \text{ rise in cooling water}}$$

= 274 lb. cooling water required = 33 gal.

Cost per 1000 B.t.u. latent heat removed

0.90 lb. 78.5% $CaCl_2$ at 1.7 cents per lb.	= 1.53 cents
33 gal. cooling water at 10 cents per 1000 gal.	= .33 cents
	1.86 cents

With these unit costs as a basis we can compare the net costs of cooling and dehumidifying air per 1000

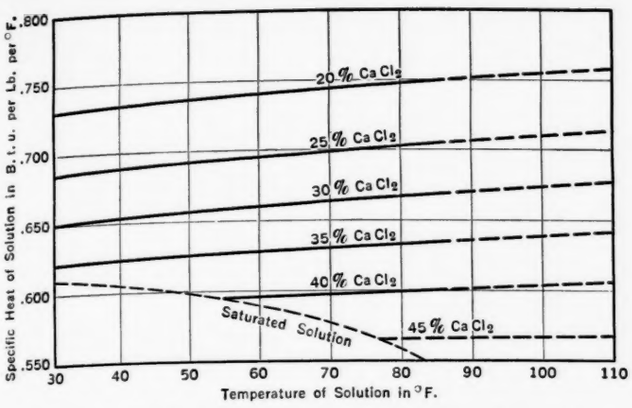


Fig. 6. Specific heat of calcium chloride solutions in B.t.u. per pound per °F. versus temperature for various solution compositions

B.t.u. of total heat to be removed for two cases where the latent heat load amounts to 25% and 50% of the total heat load as follows:

Comparative costs per 1000 B.t.u. total heat removed where latent heat amounts to 25% of the total load

Using Ice

$$\frac{\text{250 B.t.u. latent heat}}{\text{1000 B.t.u. total heat}} \times \text{1.234 cents} = \text{0.309 cents}$$

$$\frac{\text{750 B.t.u. sensible heat}}{\text{1000 B.t.u. total heat}} \times \text{1.234 cents} = \text{0.925 cents}$$

Total ..... = 1.234 cents

Using Calcium Chloride and Cooling Water

$$\frac{\text{250 B.t.u. latent heat}}{\text{1000 B.t.u. total heat}} \times \text{1.86 cents} = \text{0.465 cents}$$

$$\frac{\text{750 B.t.u. sensible heat}}{\text{1000 B.t.u. total heat}} \times \text{.30 cents} = \text{0.225 cents}$$

Total ..... = 0.690 cents

Comparative costs per 1000 B.t.u. total heat removed where latent heat amounts to 50% of the total load

Using Ice

$$\frac{\text{500 B.t.u. latent heat}}{\text{1000 B.t.u. total heat}} \times \text{1.234 cents} = \text{0.617 cents}$$

$$\frac{\text{500 B.t.u. sensible heat}}{\text{1000 B.t.u. total heat}} \times \text{1.234 cents} = \text{0.617 cents}$$

Total ..... = 1.234 cents

Using Calcium Chloride and Cooling Water

$$\frac{\text{500 B.t.u. latent heat}}{\text{1000 B.t.u. total heat}} \times \text{1.86 cents} = \text{0.930 cents}$$

$$\frac{\text{500 B.t.u. latent heat}}{\text{1000 B.t.u. total heat}} \times \text{.30 cents} = \text{0.150 cents}$$

Total ..... = 1.080 cents

These figures may be summarized as follows:

	To Remove	*Cost per 1000 B.t.u. removed*
1.	Sensible heat, using ice	1.234 cents
2.	Sensible heat, using cooling water	0.300 cents
3.	Latent heat, using ice	1.234 cents
4.	Latent heat, using 78.5% $CaCl_2$, plus cooling water	1.860 cents
5.	25% latent heat, 75% sensible heat } using ice	1.234 cents
6.	25% latent heat, 75% sensible heat } using 78.5% $CaCl_2$ plus cooling water	0.69 cents
7.	50% latent heat, 50% sensible heat } using ice	1.234 cents
8.	50% latent heat, 50% sensible heat } using 78.5% $CaCl_2$ plus cooling water	1.08 cents

The conclusions from these comparisons are that it is cheaper to remove sensible heat with cooling water than it is with ice. It is cheaper to remove latent heat with ice than it is with the use of calcium chloride and cooling water. It is cheaper to remove heat with calcium chloride and cooling water than it is with ice when the latent heat to be removed amounts to less than 50% of the total heat to be removed. By substituting actual material costs at particular localities in the above calculations the actual cost of cooling and dehumidifying may be calculated.

In localities such as Milwaukee and Chicago, which have relatively low summer water temperatures, the water and calcium chloride charge will be lower than above indicated. It might be pointed out that cooling water used in the air conditioning equipment could be used to water the lawn and give a credit to the operating cost of the unit.

In regard to materials of construction for dehumidifying equipment using calcium chloride we would recommend mild steel. This is based on plant experience in the manufacture of calcium chloride. At one point in the process there is a 20 ft. diameter steel surge tank which shows but little evidence of corrosion after having been in service for 17 years, during which time the inside surfaces of it have been exposed to 40% calcium chloride solution and air at temperatures above 110°. As an added protection the interior of the dehumidifier box should be sandblasted and painted.

Up to this point we have been considering the use of calcium chloride solutions for dehumidifying air. Calcium chloride solutions also offer a simple means of regulating the relative humidity of air in winter without the use of a humidistat. To do this, air is passed over a calcium chloride solution which has the proper concentration to give the desired relative humidity. The volume and concentration of this calcium chloride solution is maintained constant, automatically, by the addition of service water through a float-controlled valve. The service water replaces the water evaporated to the air, and the calcium chloride solution limits the percentage saturation of the air with moisture.

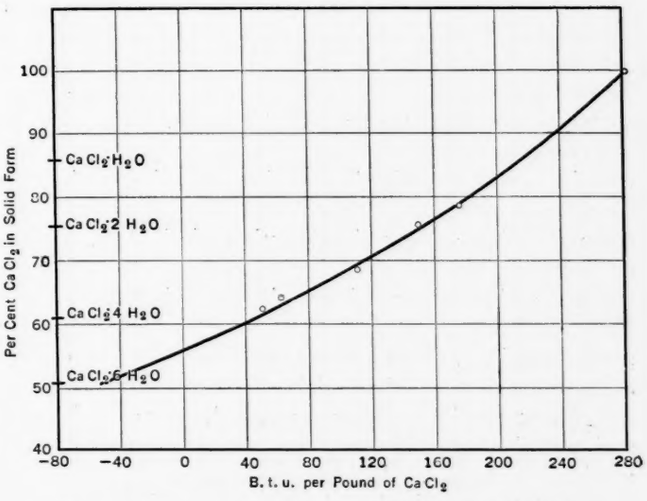


Fig. 7. Heat of solution of solid forms of calcium chloride to infinite dilution at 65°.

Courtesy Baker Smith & Company

Fig. 1. Example of ductwork in a New York bank building. All ductwork was later concealed in a hung ceiling.

Air Conditioning

By WILLIAM HULL STANGLE
and
REALTO E. CHERNE†

Part XIX—Fabrication and Erection of Ductwork

WELL-PLANNED air conditioning plants, even though based on painstaking, and at times tedious, calculations, may be found ineffectual because of careless fabrication and erection of the distributing and return systems—so-called "common" ductwork.

Too often an engineer is called out to locate trouble-creating objectionable distribution or noise, and finds such obvious faults in erection of the iron work as seams lapping against the direction of air flow, sizable obstructions in the ducts, and faulty elbows, offsets, throats, and transformations. All the objections cannot be heaped upon the mechanics' work because the designing engineer often lays out a scheme without giving consideration to such problems as: how ducts and equipment can be hung or supported, space conditions, and coordination of installation with the various other mechanical trades. It is obvious that accurate scale drawings are required and such nonsensical tricks as showing a wall or structural steel member slightly out of location to accommodate or ease the close fit of a piece of equipment, and then trusting to the ingenuity of an erection superintendent to fit the apparatus in, should not be tolerated.

Galvanized iron has for many years been the accepted material for air ducts and apparatus connections in most ventilating or air conditioning work. In comparatively recent years the practice of using copper bearing galvanized iron has increased. Although the material cost is slightly higher than for galvanized iron, there is a saving in labor because copper bearing steel can be more easily worked.

Where ductwork is continuously subjected to the elements, it is common practice to use copper and to solder all points to insure against leakage. For example, fresh air intakes and exhausts through roofs, etc., are commonly made of copper.

Occasionally, allegheny metal, duramet, super as-

†Carrier Engineering Corporation.

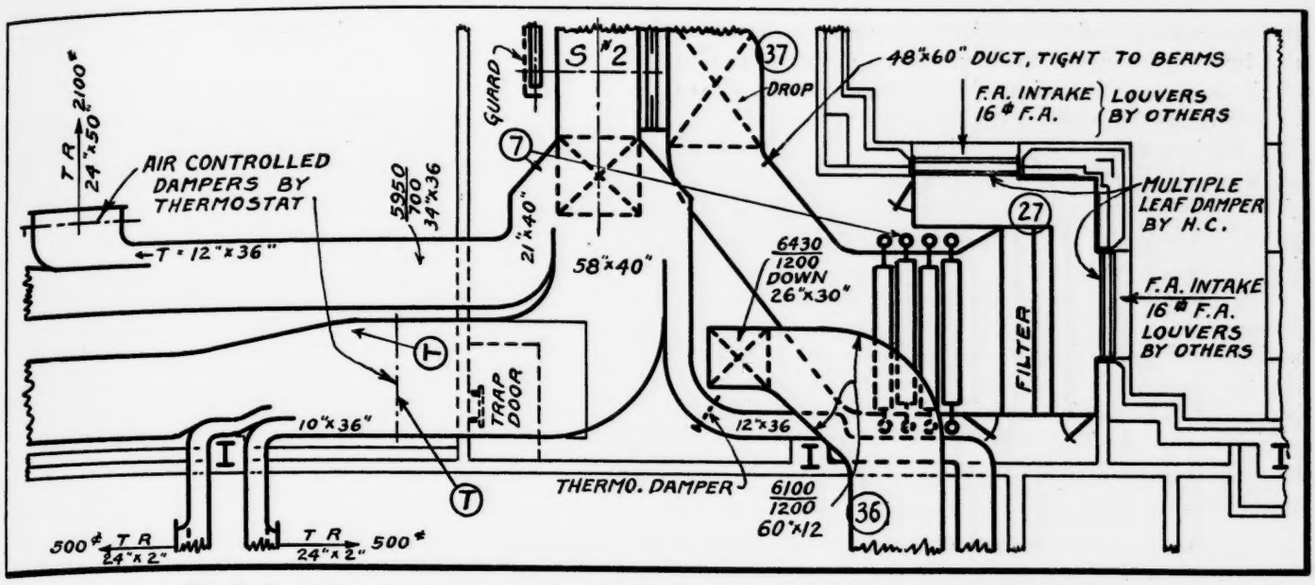


Fig. 2. A section of a typical drawing of ductwork, as made by the consulting engineer

coloy, and other alloy metals are required to prevent corrosion which may be caused by acidic, or similar, action. Ducts used, for example, for restaurant or cafeteria kitchen ventilation, particularly the exhaust systems, are generally constructed of corrosion-resisting material, although on many such installations heavy gauge black iron is utilized. In some installations where corrosion has been experienced, it has been found necessary to treat the water being circulated in the system to eliminate the conditions that cause the deteriorating action. Such treatment may be handled automatically by the addition of suitable equipment.

In the majority of cases the ductwork is designed or laid out by the consulting engineer in cooperation with the architect, the size, cross-section, and general location being determined from capacities and load concentrations as well as to meet the requirements and limits established by the architect. A typical example of such a layout is shown in Fig. 2.

When the ventilating or air conditioning contract has been awarded, together with the other mechanical trade contracts, a composite mechanical drawing is usually prepared by the mechanical staff of the general contractor. This drawing correlates all these mechanical trades with the structural and architectural features in order that the exact location and elevation of all ductwork, piping, conduits, structural members, architectural details, etc., do not conflict in any way.

During the time of preparation of the composite drawings, the ventilating or air conditioning contractor is preparing shop drawings which are ultimately approved by the architect or engineer. After approval, the shop drawings are sent to the sheet metal shop for fabrication of ductwork. Fig. 3 is a typical example of a sheet metal shop drawing.

It is essential that all trades involved in the erection of a large modern building (inherently a complex problem) properly correlate *all* their work. Experience has shown the above described method of preparation of composite drawings to be satisfactory. Contracts for

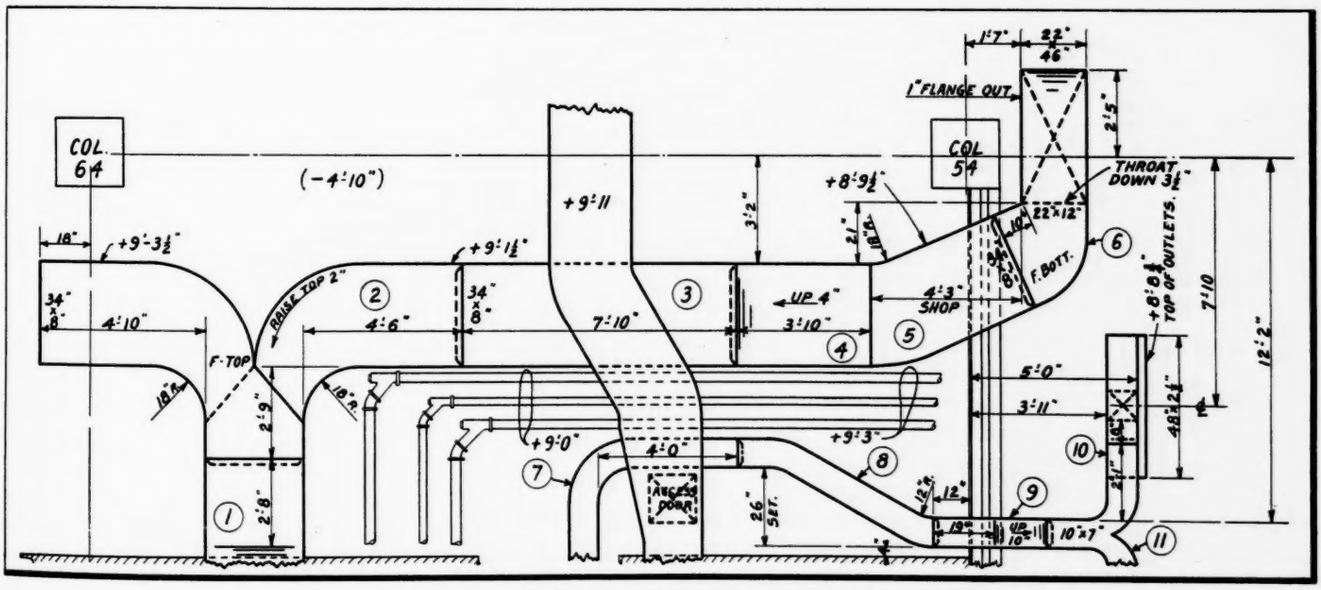


Fig. 3. A section of a typical drawing made by the sheet metal shop for its working drawing

the mechanical trades should be consummated early in the building program to insure proper representation of the sub-contractors in order that all difficulties may be overcome without penalizing any contractor for excess work which might arise in event of conflict. In other words, the actual erection must necessarily be a give-and-take proposition. Another advantage of such procedure is that the owner is assured full cooperation from the sub-contractor.

Since the raw material ordinarily used in duct construction is galvanized iron, it is essential to have an understanding of the required weights or gauges of sheets, sizes and shapes of hangers, stiffeners and braces, and the stock sizes of each readily available.

Table 1 gives the gauges of sheet metal commonly used in this work, together with thicknesses and unit weights.

TABLE 1

GAUGES AND WEIGHTS ORDINARILY USED IN DUCT AND APPARATUS CONNECTION CONSTRUCTION

U. S. Standard Sheet Metal Gauge

Gauge No.	Thickness, In.*	Weight, Lb. per Sq. Ft. Steel	Galv.
8	0.1685	6.88	7.031
10	0.1379	5.63	5.781
12	0.1072	4.38	4.531
14	0.0766	3.13	3.281
16	0.0613	2.5	2.656
18	0.0490	2.00	2.156
20	0.0368	1.5	1.656
22	0.0306	1.25	1.406
24	0.0245	1.000	1.156
26	0.0184	0.75	0.906

*Thickness of galvanized sheets approximately 0.004 in. greater.

Table 2 gives the same information for sheet copper.

TABLE 2

WEIGHT AND THICKNESS, COPPER SHEETS ROLLED TO WEIGHT

Weight per Square Foot Oz.	Lb.	Thickness, In.
48	3	0.0648
36	2¼	0.0486
28	1¾	0.0378
24	1½	0.0324
16	1	0.0216

Table 3 gives notes concerning sizes used in air conditioning and ventilating ductwork and apparatus connections.

TABLE 3

NOTES

1. Angle iron stiffeners usually 1½ in. × 1½ in. × ⅛ in. weighing 1.23 lb. per ft. or 1 in. × 1 in. × ⅛ in. weighing 0.80 lb. per ft.
2. Band iron hangers and stiffeners usually 1 in. × 3/16 in. weighing 0.638 lb. per ft. or 1¼ in. × ¼ in. weighing 0.48 lb. per ft. or 1 in. × ¼ in. weighing 0.425 lb. per ft.
3. Standard size sheets (30 gauge or heavier, in even gauges). Widths 24 in., 26 in., 28 in., 30 in. and 36 in. Lengths 72 in., 84 in., 96 in. and 120 in.
4. Band iron stock lengths 18 ft. and 20 ft.
5. Angle stock lengths 20 ft. and 25 ft.

To insure proper strength and to prevent generation of unnecessary noise, certain empirical rules have been established as a result of long experience, by which the proper gauge of metal may be selected for a given sized duct and for a given utility. Table 4 applies to many practical installations, and has been in use for some time by reputable engineers and contractors.

TABLE 4

GAUGES OF IRON AND DUCT SIZES

Round Ducts

Seam—Inches	Gauge
6 to 29	24
30 to 39	22
40 to 49	20
50 and above	18

Rectangular Ducts

Standing Seam (Panel Construction)

Greatest Dimension, Inches	Gauge
up to 34	24
35 to 48 (1 in. stdg. seam)	22
49 to 60 (1½ in. stdg. seam)	22
61 to 90 (1½ in. stdg. seam)	20
over 90	18

Planing Mill and Other Exhaust Systems

Dia.—Inches	Gauge
up to 8	24
9 to 14	22
15 to 20	20
21 to 30	18
31 to 39	16

Pittsburgh Lock or Grooved Seam

Inches	Gauge
up to 24	24
25 to 35	22
over 36*	20

*Stiffened with angle irons on 4 ft. centers. On 36 in. to 80 in. wide use 1 in. × 1 in. × ⅛ in. angles; on 81 in. to 120 in. wide use 1¼ in. × 1¼ in. × ⅛ in. angles; on ducts over 121 in. wide use 1½ in. × 1½ in. × 3/16 in. angles.

Specifications on ductwork vary from these tables according to the requirements to be met, but the essential point to be borne in mind by the engineer is that the ductwork must be substantial, economical to construct, and workmanlike in appearance.

Tables from which the weight per lineal foot or square foot of surface of ducts of various sizes can be quickly summated are readily available in several places.

A sheet metal shop may well be likened to an orderly tailoring establishment with the sheet metal representing the cloth or fabric; the layout man corresponding to the cutter; the shop mechanic to the seamster; and the erecting mechanics to the fitters, tailors and bushelmen.

Technically, duct and other sheet metal work is the development of surfaces representing solids or intersections of solids.

The metal sheet is laid out full size for the surface for which it is intended, due allowance being made for joints and seams, after which it is cut to the exact shape required either by hand shears or power shears, depending upon the thickness of the sheet. For heavy sheets, or curved cutting, power-driven rotary shears are often applied.

Next, the joints or seams are prepared either by a power brake or by hand, depending on conditions. The brake is also used for any special beading or creasing that may be required. In the better class of work where panel construction is used, all sides or surfaces are given a "diamond brake." That is, the sheets are slightly bent diagonally both ways as illustrated in Fig. 8. Besides giving a neat and trim appearance, this type of construction has the added advantage of stability, is less liable to vibration, and can be extended in long runs without warping.

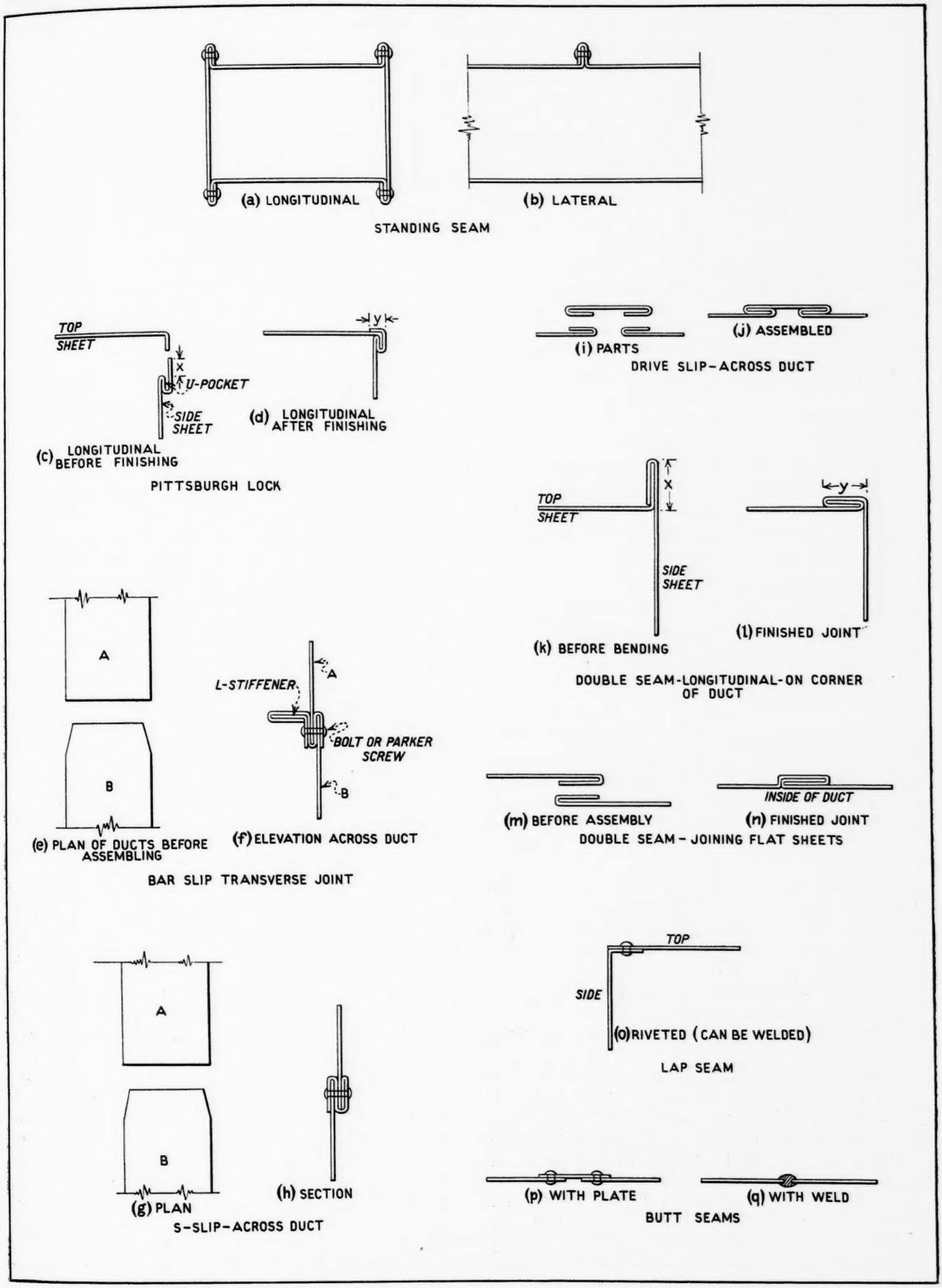


Fig. 4. Several types of joints and seams in common use in the fabrication and erection of ductwork

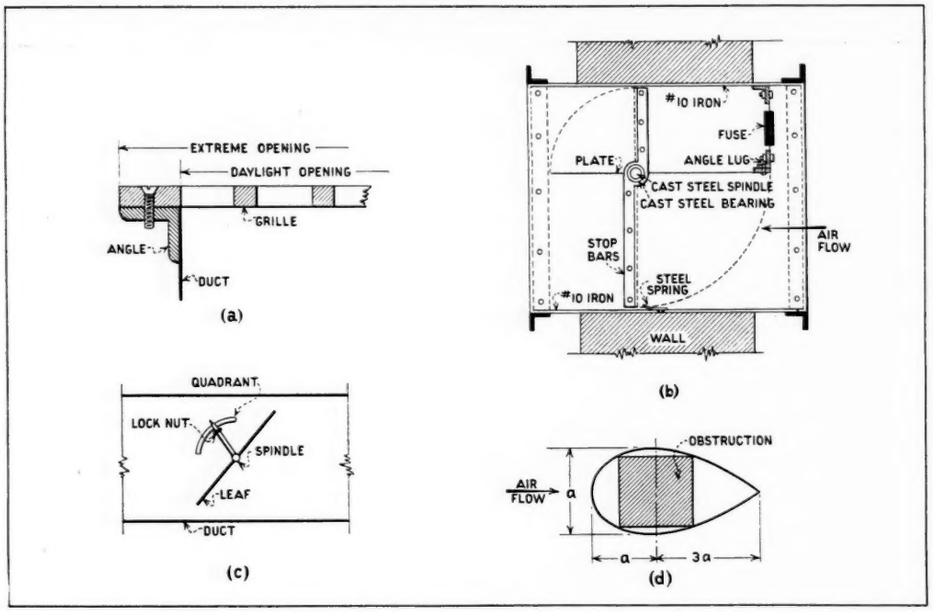


Fig. 5. Miscellaneous details used in ductwork.

After preparation of the individual surfaces, they are assembled into duct sections by making the joints at the edges. The ends of the sections are at the same time prepared for field erection.

There are several types of joints or seams in common use in the fabrication and erection of ductwork, the chief of which are shown in Fig. 4.

Detail (a) indicates the construction of a longitudinal standing seam. The vertical side sheet is given two 90° brakes over the standing edge of the top sheet, peened tight and riveted or button punched as indicated.

Detail (b) indicates a lateral standing seam. In this construction the end of each section is given a 90° brake, the leg of one being longer than the other, practically equal to the height of the standing seam. The long flange or leg is then bent around the short flange to form a 180° socket, and the entire joint is peened and riveted.

Detail (c) indicates the component parts of a longitudinal Pittsburgh lock joint. The side sheet has the edge prepared in the shop brake with the extension labeled (x) in position as shown except that the "u" pocket is closed due to the pressure of the brake. The "u" pocket is then opened up by hand and the top sheet bent edge inserted, after which the flange (x) is bent over into position (y), as shown in (d). Detail (d), therefore, is the finished joint.

Detail (e) indicates a bar slip type of transverse joint. In this construction the section of duct A is inserted into the pocket of a slip and section B likewise inserted into an adjacent pocket. The whole is then peened down and secured with bolts or parker screws. The section of the stiffener extending outside the duct may be further strengthened by insertion of an angle, as shown dotted in (f).

Details (g) and (h) indicate an S-slip type of transverse joint. This construction is somewhat similar to detail (f), except that the stiffener is peened down to produce a flat joint.

Details (i) and (j) indicate a drive slip type of transverse joint, wherein the clip or drive slip is driven over the ends of the formed edges of the sheets to be joined and the whole joint peened flat.

Detail (k) shows a longitudinal double seam wherein the vertical standing seam "x" is bent over into position "y", eliminating the necessity of riveting or buttoning. The finished joint is shown in detail (l).

Details (m) and (n) depict a double seam generally used to join flat sheets. The prepared edges of the adjacent sheets are hooked together and the joint peened down. This joint is not effective when in compression. The lap is offset, as indicated in the detail of the assembled joint, to present a smooth surface to the inside of the duct.

Detail (o) shows a lap seam. The side sheet is flanged with a 90° brake and the top sheet riveted to the flange. This joint may be welded instead of riveted.

Detail (p) shows a riveted butt seam and (q) a welded butt seam.

The lap and butt weld seams are rarely used except in the heavier gauge metals.

The construction of elbows, tees, splitters or Y's, and transitions are accomplished in a manner similar to that used in the fabrication of straight runs. The only difference in these fittings is in the development of their surfaces.

Most sheet metal contractors maintain well-organized shops for the efficient production of sheet metal work in order that they may meet competition. The fabrication of ductwork in such shops has become necessary for urban work because of the usual congestion at the site of the larger city building projects. However, it has been found advantageous on many installations to locate a shop at the site where ample space may be available without prohibitive cost. It is also frequently found that the raw material (sheets and shapes) can be delivered at the site much cheaper than the fabricated ductwork. In other words, the location of the shop is purely a matter of economics.

After the ductwork is fabricated it must be erected in its proper place in the building. It is important that the erection superintendent properly schedule the de-

livery and distribution of the fabricated material to the various parts of the building with the least amount of handling in order to reduce the handling charges and to prevent confusion and needless damage to the fabricated material. Each member or section should be properly labeled and correlated to the erection drawing to insure efficiency on the part of the erectors. Only the amount of material necessary to keep the erection force properly active should be delivered to the site to prevent excessive storage losses and congestion. Any material stored should be protected against damage.

Several methods have been employed in the suspension of ductwork from the structural arches. A much-used method is to pierce the arch (from below, since the general contractor rightfully objects to piercing the arch from above for structural reasons) and inserting suitable hangers. In some instances, expansion or toggle bolt hangers are inserted in the bottom of the arch, but this particular method is not entirely satisfactory in cinder or hollow tile arches. Perhaps a better arrangement, where time in layout permits, would be to spot hanger locations on the working drawings and insert them in conjunction with the forming of the arch. This practice results in the elimination of unnecessary patching, reduces erection costs, and makes a workmanlike job.

Obviously, all ductwork must be erected in its proper location. The location of the ductwork horizontally is generally determined by reference to a monument line established by the surveyor representing the general contractor. These reference lines are usually located several feet inside the building line and generally parallel to it. The elevation of the bottom of the ductwork is similarly determined from established bench marks which are usually located several feet above the theoretical finished floor line. Experience has shown that the practice of locating these monument lines and bench marks as explained above is most convenient to all concerned. It is of vital importance that all outlets, inlets, access doors, and duct surfaces be accurately located because even minor adjustments are costly and needless.

It is equally important that all details, such as nozzle openings, dampers, stream-lining of obstructions, etc., be as carefully executed as the fabrication and erection of ductwork proper. Fig. 5 shows several such details. Detail (a) shows an accepted method of forming of the outlet or inlet opening by the use of an angle frame. The register or grille is fastened to this frame just prior to the completion of the system, usually after the plaster work has been completed. If the grille is of unfinished metal, it is erected before painting and is painted along with the plaster surfaces. Finished grilles are usually applied after the general painting has been completed. Often the grilles or registers are fastened to a flange on the end of the duct, an angle iron frame not being required.

Detail (b) illustrates a section through a common type of fire damper. Fire dampers are usually constructed of heavy gauge black iron depending upon underwriters' requirements. The damper leaf is mounted on a shaft that is set eccentric in the damper box to provide unbalanced weight to favor closing the damper (by gravity) when the fusible link gives way. The fusible link is made of a low melting point alloy usually fusing at about 120° F. It should be noted that the damper closes in the direction of air flow and that there is a spring clip at the bottom of the duct and a stop at the top of the duct to prevent a reopening of the damper without manual attention. An access door should always be provided in the duct on the fusible link side of the damper to permit inspection and renewal of the link.

Detail (c) illustrates the usual type of hand volume or by-pass damper. The leaf and spindle are inside the duct. One end of the spindle extends through the side of the duct and is fitted with a lever which engages a quadrant. The damper may be held in any position by means of the lock nut, as shown.

While it is not considered good practice to allow any obstruction in a duct, conditions sometimes permit hanger rods, small pipes, or the like. In such event, the obstruction should be stream-lined, as indicated in detail (d). If the obstruction is relatively large it may be necessary to increase the cross-sectional area of the duct to prevent too great a friction drop in the section.

Automatic dampers and louvers have been described in previous articles.

An important detail which must always be considered is the proper design of the ductwork and connection at the apparatus. Ordinarily, a flexible connection is made between the fan discharge and the initial duct. The material generally used for this flexible connec-

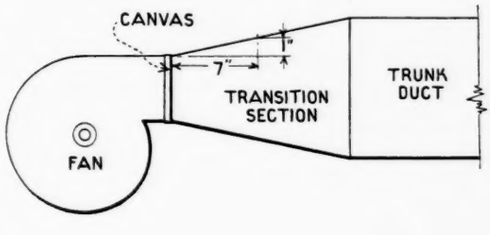


FIG. 6

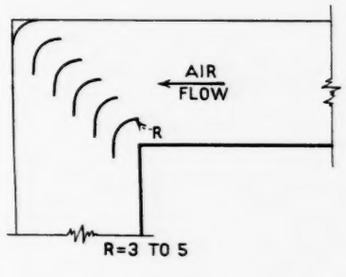


FIG. 7

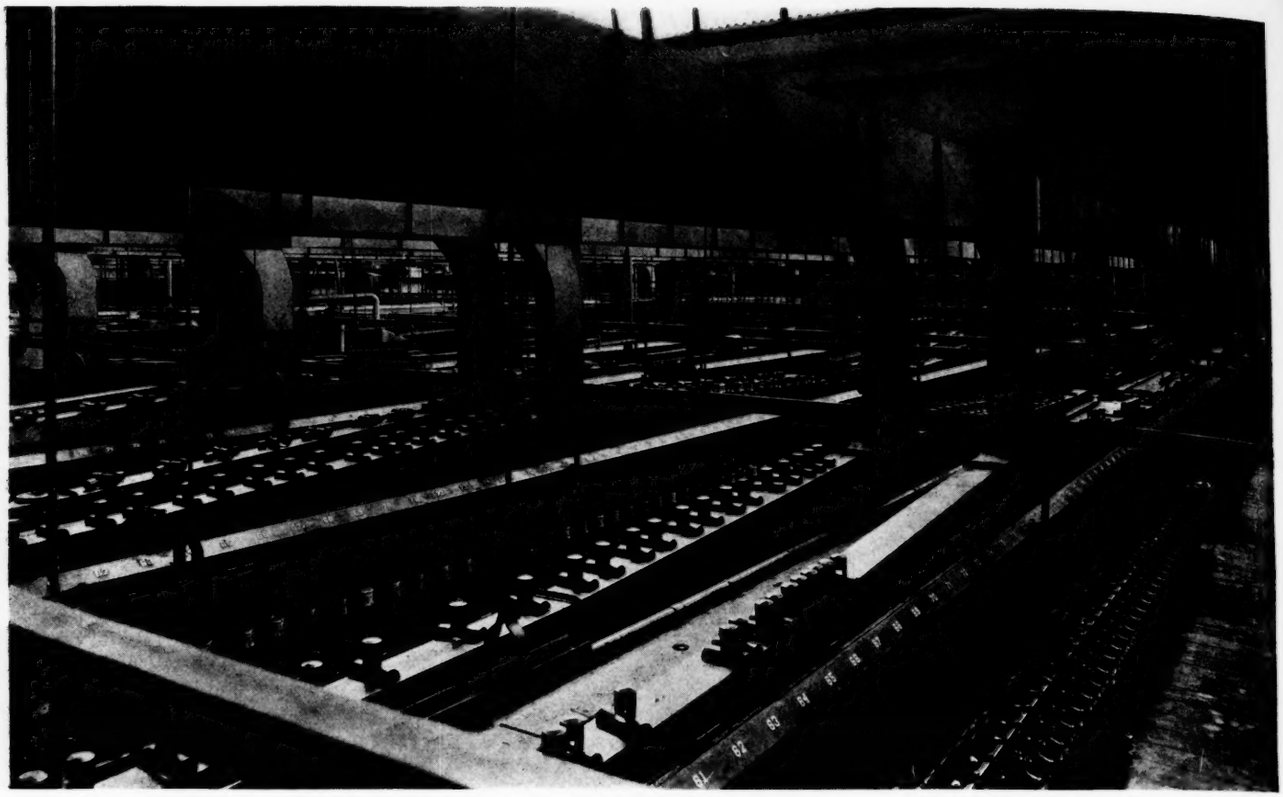


Fig. 8. An installation of ductwork in a textile mill. The "diamond brake" can be seen in the large duct overhead

tion is 10 oz. canvas. It is important that the canvas be securely fastened and made tight by sewing to prevent excessive air leakage. The canvas should not be painted. Sometimes a like connection is made on the fan inlet.

The initial ductwork from the fan discharge should be designed with a well-tapered transition to the trunk line of duct. Where possible the taper should be about 1 in. per 7 in. of length, as shown in Fig. 6. However, it is not always feasible to make such a connection, but in any case the ratio of 1 to 5 should be the maximum taper.

For fan inlet connections and heater stack connections the same rules are adaptable.

Where turns are encountered and the space conditions are very limited, it may be necessary to utilize square elbows or suitable vanes in short radius elbows (Fig. 7). The radius of the vanes and the distance apart is determined by the width of the elbow. Ordinarily, the radius varies from 3 in. on small ducts to 5 in. or more on large ducts. Splitters and deflectors are used in take-offs, Y's and in large sweep elbows, and are designed on empirical data which at present is so much in variance that no set rules can be given.

Moscow Fifth in Central Heating

MOSCOW stands fifth among all cities in the world in centralized heating. The development of the centralized heating system foreseen for the next three years will place Moscow in the foremost place in this respect.

According to a general plan, Moscow's centralized heating system will give, by 1937, 80% of all the heat required by that city. At present, it covers only 5% of the heating. The centralized heating system is to be combined with the city's power system, as from the point of view of technique and cost the combined heat and power production is most efficient.

Only 20% of fuel is being utilized under the present method of operation. Under the combined centralized heating and power system it will be possible to utilize 60% of the fuel.

Coal from the Moscow district is to be used as the principal fuel. So far, only 3% of local coal is used in the heating of Moscow, 78% of the fuel used is Dones coal and oil. The plan provides that 87% of all fuel used in Moscow shall consist of Moscow coal.

Energetic measures are taken to build the equipment necessary for a centralized heating system in Moscow.

—*Power.*

EDITORIALS

Separation of Contracts

SEPARATION of the mechanical contracts from the general building contract is gaining ground in private work and is used in some state, municipal and county work. Building contracts of the federal government are let in accordance with the practice of the government department supervising them. For some time, moves looking toward making the separation compulsory for federal work have been carried on but without tangible results. Last month H. R. 9975 was introduced in the House by Patrick J. Carley of Brooklyn, N. Y. It would compel all government officers charged with the duty of preparing specifications to separate the contracts for heating and piping, electrical work and plumbing. The bill was referred to the Committee on Public Buildings and Grounds, where it now rests as we go to press.

On April 7 and 8 public hearings were held by the committee to permit both the proponents and those opposed to the bill to be heard. The first step in securing passage of the bill is to get a favorable report by the committee. The text of the full bill is printed elsewhere in this issue. The bill is of vital interest to all heating contractors whether directly engaged in federal work or not. If the federal work is let through separate contracts it will undoubtedly help to popularize the use of the idea for private and state work. We urge our readers to use their influence now by emphatically calling the attention of their representatives in Congress to the importance of this bill and to the desirable results which would follow its enactment.

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Coordination of the Construction Industry

THE disastrous slump in the building industry is not wholly without its benefits, for its serious effects are causing not only government action but private agencies are also taking notice of it. Among those which have interested themselves is the Chamber of Commerce of the United States. One of the major subjects to be considered at its May meeting in San Francisco is that of means of stabilizing the whole construction industry through coordination of effort.

Silas H. Strawn has summed up the difficulties by raising several questions which are so pertinent that they will stand repeating.

"Does the construction industry lack the degree of unified control, coordination and precision essential to success in the manufacturing industries?"

"What can be done nationally and locally to overcome any such hardships? Is there need for developing a combined business judgment on practical procedures for the solution of common and basic problems in the construction field? If such procedures are agreed upon, will they be utilized by contractor, architect, engineer, banker, manufacturer of building materials, and others?"

"What will be gained by increased efficiency in the construction industry and by prevention of the excesses of real estate and building booms and the depressing after-effects on employment and property values?"

This is an excellent outline of the questions. No one will deny that they are real. The point is—will the discussion lead to any concrete proposal?

If it even succeeds in clarifying the whole atmosphere and bringing the true difficulties into strong relief, something will have been accomplished. Certainly, it is doubtful if the whole question would be even opened for discussion except for the present unpleasant depression. In that way, at least, the depression is not without its bright side.

●

The Fuel Situation

THE competitive situation among the fuels used for building heating continues to be a matter of considerable interest as the several forms continually change their relative positions in regard to cost. To engineers who must often base their recommendations on the probable cost over a period of years, the current charges are confusing. Conditions are changing rapidly and today's conclusions may not hold tomorrow.

Disagreements between the miners and operators in the bituminous fields, particularly in Kentucky, Indiana, Ohio and Illinois, are an important contributing factor to the unsettled condition now existing in that industry. The proposed embargo on oil, if passed, may be expected to result in somewhat higher prices for fuel oil.

The anthracite interests are having plenty of trouble. Preliminary estimates are that the consumption of hard coal decreased 35% from 1923 to 1931. The House has passed a tariff of $2 per ton on imported anthracite. In addition, the government is studying the advisability of placing an embargo on Russian anthracite. Competition with other fuels, and with imported coal, has resulted in the price of this commodity being the lowest in ten years. One of the largest anthracite producers is building a second super-breaker which will further eliminate hand labor and result in the production of a better fuel. On the other hand, labor troubles are present in the hard coal fields. In this case, the war is apparently among two factions of the miners, rather than between the miners and owners.

The declining prices of the solid fuels have further widened the gap in cost between them and manufactured gas. However, the expansion of the territories served by natural gas is continuing, although at a declining rate. Manufactured gas utilities may be forced to grant further reductions in rates if they are to continue to meet severe competition with other fuels.

In the face of all these changing tendencies and possibilities it is a wise man who can attempt to predict their relative costs for any reasonably long period.

Your Everyday Problems

Mr. Hanburger will be glad to answer your problems relating to installation and operation of heating and ventilating systems, and wherever possible will give the reasons for his suggestions. Letters will be answered direct to the inquirer and in some cases published anonymously. If sketches are included they should be clearly drawn. Write Mr. Hanburger, HEATING AND VENTILATING, 148 Lafayette Street, New York.

Conducted by FRED W. HANBURGER

QUESTION 42. In a Bureau of Standards circular, "Thermal Insulation of Buildings," it is stated that from 50% to 80% of the heat transfer across air spaces of ordinary sizes takes place by radiation, and that if the air spaces were bounded by bright metallic surfaces, this transfer by radiation would be greatly diminished. Two questions arise:

1. How much, if any, decrease in this transfer by radiation could be attained by the application of white or metallic (aluminum) paint on the interior of the sheathing material, the paper bonds of an ordinary blanket insulation, or both? Would the saving thus obtained justify the expense involved?

2. How much would this transfer by radiation be retarded by the use of loose rock wool insulation which completely fills the space?

Both of these questions are concerned with the air space found in ordinary dwellings, between the studding. *F. C. P.*

ANSWER. While the results of experimental tests give sufficient information to enable us to arrive at a fairly definite estimation of the radiant heat through the walls of our buildings as constructed at the present time, yet the heat of radiation, convection and conduction obeys such widely different laws and varies under changing conditions that with the data at hand, it is not possible definitely to separate them under conditions different from those under which the tests were made.

The amount of radiant heat emitted and absorbed depends upon the nature of the surfaces, the difference in temperature between the two surfaces, and varies inversely as the square of the distances between the radiating and absorbing body.

The first condition is expressed by the Stefan-Boltzmann law in the form

$$H = K\left[\left(\frac{T_1}{100}\right)^4 - \left(\frac{T_2}{100}\right)^4\right]$$

where K represents the emissive value of a black surface and whose value is approximately 0.17, and to which all other surfaces are referred.

To arrive at a clearer understanding it is sometimes well to use what data we have at hand and attempt to separate the radiated heat.

Fig. 1 shows a section of wall of frame construction. The *coefficient of transmission*, U_h, for the hollow section of the wall is

$$U_h = \frac{1}{\frac{1}{1.34} + \frac{1}{4.02} + \frac{1}{1.10} + \frac{1}{2.50} + \frac{1}{1.6} + \frac{1}{1.143}} = 0.263$$

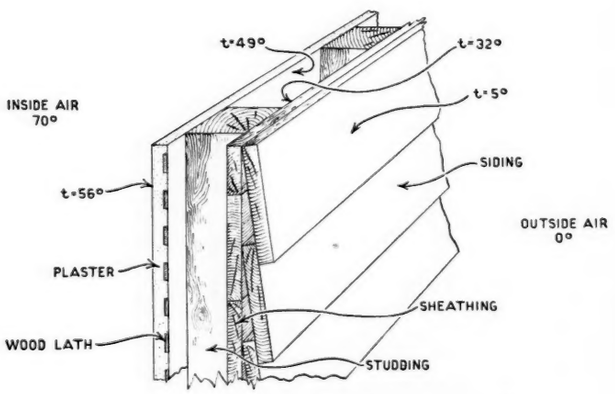

Fig. 1. Values of conductances

Air space	= 1.10
Lath and plaster	= 2.50
Siding	= 1.6
Sheathing	= 1.143
Studding	= 0.276
Rock wool (3⅝ in.)	= 0.09
K_1	= 1.34
K_2	= 4.02

If the open section were now filled with rock wool with a conductivity of 0.28, giving a conductance of 0.09 for a thickness of 3⅝ in., the *coefficient of conduction*, U_f, through the filled partition will be

$$U_f = \frac{1}{\frac{1}{1.34} + \frac{1}{4.02} + \frac{1}{2.50} + \frac{1}{.09} + \frac{1}{1.6} + \frac{1}{1.143}} = 0.09$$

Returning to the hollow wall, with a U_h value of 0.263 the heat transmitted through 1 sq. ft. of this wall with a room temperature of 70° F. and outside temperature of 0° will be

$$70° \times 0.263 = 18.41 \text{ B.t.u.}$$

The temperature of the wall surfaces in the room must then be

$$70° - \frac{18.41}{1.34} = 56°$$

while the temperature of the inner surface of the plaster will be

$$56° - \frac{18.41}{2.50} = 49°$$

These and other temperatures are shown in Fig. 1.

An extensive series of tests was made by E. R. Queer, instructor in engineering research, Pennsylvania State College, and presented in a paper before the A.S.H.V.E. to determine the emissivity factor of aluminum foil surface and its variation with the mean temperature to the space between the hot and cold surfaces. Abstracts of this paper were published in the December, 1931, issue of HEATING AND VENTILATING. Many interesting features have been developed by Mr. Queer, and I feel sure that a perusal of this paper will be of much interest to you.

In this discussion he applies the Stefan-Boltzmann law in the form

$$H_r = 0.172 \times \frac{e_1 e_2}{e_1 + e_2 - e_1 e_2} \left[\left(\frac{T_1}{100} \right)^4 - \left(\frac{T_2}{100} \right)^4 \right]$$

where e_1 and e_2 are the emissivity factors for the hot and cold surfaces.

Using the above method, and the value of e for plaster and rough board surface as 93%, the amount of heat radiated through the air space of Fig. 1 would be 12.79 B.t.u., and the amount transmitted by conduction and convection would be 18.41 — 12.79 = 5.62 B.t.u. giving a ratio of radiant to total heat equal to 70% approximately.

It should here be noted that as the amount of radiated heat depends upon the absolute temperatures of the hot and cold surfaces, and that these temperatures are dependent on the conductivity of the material of which the sides are composed, so that the per cent of radiated heat must vary with the type of construction.

Painting of the sides of the air space with a bright metallic paint will reduce the quantity of radiated heat. Taking the relative emissivity of a bright shining surface as 0.1, and using the same temperatures on the surfaces, the amount of radiant heat would then be only 0.8 B.t.u., giving a total heat conductance of

$$5.62 + 0.8 = 6.42 \text{ B.t.u.}$$

and a value of U of $\frac{6.42}{70} = 0.092$. This, however, is on the assumption that the temperature of the surfaces remains the same, but with the smaller value of U this cannot be the case. There is still a dearth of data in this respect.

In an illustrated lecture by Prof. F. B. Rowley, of the University of Minnesota, he showed a reduction in the value of U (for a somewhat similar wall to that of Fig. 1) from 0.26 to but 0.13 after the interior surfaces had been painted with aluminum paint. This indicated that the emissivity factor of the aluminum surface must be considerably greater than 0.1 and that the surface temperatures vary greatly under the different conditions.

Comparing the results of Professor Rowley's tests with the walls of the air space covered with a shining metallic surface and a wall packed with rock wool gives a margin of practically 4% in favor of the packed wall. Its cost, however, would be greater. Professor Queer in his paper shows a still greater saving by means of foil screens.

While a saving of 50% of the heat loss is obtained through the wall surfaces, this saving is considerably less in a room where the exposed glass and infiltration form the major part of the heat loss. In the average room the saving effected would possibly range from 10% to 15%.

QUESTION 43. I have installed a coil in a heating boiler and on two occasions the pipe burst as shown in sketch. This happened in the morning. The range boiler is copper and the coil and connecting pipes are of brass. The coil, at one time, was located at the side of the firebox, and as it did not supply enough hot water in this position it was later placed in the center of the firebox. I am at a loss as to how to eliminate the possible bursting of this pipe in the future, and I shall be grateful if you can suggest something which may overcome the trouble. *R. T.*

ANSWER. When the Volstead Law came into being and a number of people went into contraband manufacture we heard of a number of stills bursting. This was not due to any inherent defect in the coils or boiler, but rather to the operator's haste in creating more steam than the coils could carry away. The resistance to this flow caused so much pressure that something had to give. This is the main cause of the trouble in Fig. 2. The ¾ in. pipes are rather small to carry away the water, as it is heated, by the large coil area. This pipe should be larger, and I would recommend a size of 1¼ in. at the least. Another factor that no doubt is causing trouble is the air trap in the inverted loop caused by dropping the coil lower into the fire box. It would be much better to run the pipe as shown by the dotted line BC, and eliminate the pipes BF, FE, and EC. When this is done there will be no need of the air vent at A.

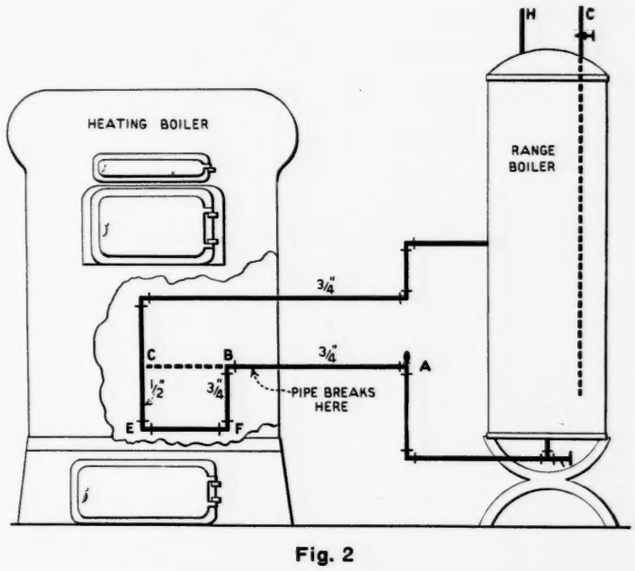

Fig. 2

Abstracts . . .

Reviews and Summaries of . . . . Current Papers, Books and Pamphlets

Proceedings of the Third International Conference on Bituminous Coal

Two-volume set; 6 in. x 9 in.; approximately 800 pages; cloth binding; illustrated; $15 per set. May be obtained through the Carnegie Institute of Technology, Pittsburgh, Pa.

The proceedings are the record of the conference and contain the full papers and discussions, totaling 98. The material represents the latest thoughts on bituminous coal technology, especially as regards such phases as carbonization, processing and production methods. Papers on domestic utilization and on dust and smoke abatement are included.

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Safety Codes for the Prevention of Dust Explosions

Bulletin of the United States Bureau of Labor Statistics No. 562: dated December, 1931; 87 pages; 6 in. x 9 in.; illustrated; obtainable from the Superintendent of Documents, Washington, D. C.; price 15 cents.

A compilation of safety codes sponsored by the United States Department of Agriculture and the National Fire Protection Association, and approved as American Standards, under the procedure of the American Standards Association. Complete text of safety codes covering starch factories, flour and feed mills, terminal grain elevators, pulverizing systems for sugar and cocoa, spice-grinding plants, wood-flour manufacturing plants, installation of pulverized-fuel plants, coal pneumatic cleaning plants, use of insert gas for fire and explosion prevention.

•

Hoyer-Kreuter Technical Dictionary

Published in Germany; sole agent in the United States, The Industrial Press, 148 Lafayette St., New York, N. Y.; sixth edition; three volumes; three languages; 7¾ in. x 11 in.; 2295 pages; price, for the three volumes, $55; for two volumes, $37.50; for one volume, $19.50.

The Hoyer-Kreuter Technical Dictionary has been published in a new and greatly enlarged edition including 100,000 technical terms, embracing various industries, arts, and sciences. This work is in three volumes: German-English-French; English-German-French, and French-German-English. Volume 1 has the German words alphabetically arranged, with definitions following in both English and French; Volume 2 has English entry words, with definitions in German and French, and Volume 3, French entry words. The technical elements of the three languages thus become interchangeable.

The earlier editions of this dictionary are specialized dictionaries limited to distinct fields, whereas this new edition is universal in scope and includes about 44,000 additional terms, covering the newest developments in science and industry.

This new dictionary will be found valuable by industrial concerns of all kinds interested in foreign developments or trade; export and import houses; research workers in laboratories and schools; libraries, etc.

Dr. Alfred Schlomann, the editor, worked in cooperation with engineering societies and manufacturers.

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House-Heating, a Reference Book on the Application of Gas to House-Heating

The third and revised edition of this pamphlet which, like its predecessors, has been prepared under the direction of the Industrial Gas Section of the American Gas Association, and edited by C. George Segeler; carries the date of January, 1932. The appearance is unchanged and the size 9 in. x 11 in. is also preserved; contains 135 pages, including a comprehensive index. Obtainable from the American Gas Association, 420 Lexington Ave., New York; price $1.50.

The text has been revised and enlarged. Among the new material added is that on the estimating of gas requirements for industrial buildings and for unit heaters. Tables of degree days are included, as are the A. G. A. requirements for the installation of conversion burners in house and water heating appliances. The chapter on Combustion and Fuels has been revised. In the chapter on warm-air heating, some new data on selection of furnaces are included, while mention is made of the important developments in fan-powered furnaces. In the chapter on testing and rating, the latest requirements for house-heating appliances are printed. An important feature is the extension of the trouble-shooting material for the field man. Included also is a bibliography of some 75 titles.

•

Air Conditioning and the Comfort of Workers

Number Five of the Industrial Health Series. Paper-covered; 20 pages; 5½ in. x 7¾ in.; illustrated. Published by the Policyholders Service Bureau, Metropolitan Life Insurance Company, New York. Obtainable by addressing the Bureau.

The little booklet is a resume of the ideas now current on this subject, and is written in popular style. It is brief, well written, and reasonably free of bias and propaganda. To the engineer who keeps informed, it contains no information not already available. It may carry some appeal to the business man to whom it seems directed. Liberal use is made of the results of

the studies at the Pittsburgh laboratory. Under the heading of Conditioned Air, a method of humidifying and dehumidifying using a fine water spray is described in terms which might easily lead to the conclusion that this particular method is the only one in use. Much the same comment can apply to other passages throughout the book, even though on the whole it is a fair exposition of the subject.

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District Heating System in Paris

From "Le Reseau Public de Chauffage de la Compagnie Parisienne de Chauffage Urbain", Le Genie Civil, 5 Septembre, 1931; 3500 words.

ABSTRACTED BY A. A. BERESTNEFF

After the application of district heating systems in the United States, Canada and Germany showed that a considerable saving can be attained by this system as compared with a case of application of an individual central heating system with steam produced in each house, "La Compagnie Parisienne de Chauffage Urbain" got a concession for establishing a district heating system in Paris.

The work was started in 1929. Up to now only one part of the whole program is finished. At the time this article was written, the maximum capacity of the central plant was 48,500 lb. of steam per hr. When the plant is completed the maximum capacity will be 70,500 lb. of steam per hr. The expected length of pipe line will be 3900 ft. Steam is produced at 142 lb. per sq. in. pressure and 572° F. Before leaving the plant the temperature of the steam is reduced to 320° F., and the pressure is reduced to the desired point. Distribution is accomplished through an 8-in. main, while the return line is 2½ in. in diameter. Another line going in opposite direction for canalization of steam of 42.7 lb. per sq. in. pressure has a main of 9.85 in. and a 3.7 in. return pipe.

Results obtained during the season 1930-1931 show that, compared with the previous individual plants with separate service, an economy in heat consumption of about 30% was reached. In cases where heating was intermittent the economy was sometimes as high as 60%.

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The Impinger Dust Sampling Apparatus as Used by the United States Public Health Service

By Leonard Greenburg and J. J. Bloomfield

A paper appearing in the Public Health Reports, of March 18, 1932, pages 654-675; includes photographs and sketches of apparatus and methods of using. Public Health Reports obtainable through Superintendent of Documents, Washington, D. C.; price 5 cents.

The paper describes the impinger apparatus and sets forth its design and construction features. In the course of doing so a good resume of the development of dust sampling and analyzing apparatus is given. The operating principles of the sugar tube, Palmer, vaseline-coated plate, thimble, and pressure drop through filter paper types of apparatus, are briefly described.

Most of the paper is devoted to the impinger apparatus in which the air to be sampled is drawn through a glass tube and impinged at high velocity on a glass plate which is kept beneath the surface of the water, or other suitable fluid, in the collecting flask. The collected sample is then analyzed. The Bureau has developed this apparatus to a point where it has become useful both in laboratory studies and in the field. During the course of time electrical, compressed-air and hand-power forms have come into being to meet special conditions as they have arisen. The apparatus is now in a high state of development.

Directions for using it and for analyzing the samples are given. The Bureau has used it for work involving atmospheres varying all the way from very dusty to nearly dust-free, as well as in those in which acid mists and lead fumes have been studied. The apparatus seems to possess the advantage of a high dust-catching efficiency over the wide range in which it has been used.

Some of the results obtained by its use are of interest. For instance, during a rainstorm, in the open air, the dust count obtained was not only very low but only a slight variation was shown between samples. In analyzing 32 samples of air obtained during certain anthracite coal-mining operations, however, not only was the average dust content nearly 800 times as great as during the rainstorm, but the maximum was over 2000 times the maximum observed during the rainstorm in the open air. Similar results from other uses of the apparatus are tabulated in the paper.

•

Heat Emission by Fin Tubes

From "Versuche ueber die Waermeabgabe von Rippenroehren", by E. Schmidt and W. Hindenburg, Archiv fuer Waermewirtschaft, November, 1931; 6600 words.

ABSTRACTED BY A. A. BERESTNEFF

Results of investigation made in "Machine Laboratory of Technology in Danzig". The investigation was necessary because of data of heat emission of fin tubes as previously found differed more than 80% from one another, being (as found in Germany) between 0.82 and 1.54 B.t.u. per sq. ft. per deg. F. per hr. The value of 1.13 (in these units) as recommended by German "Regulations" may cause an error of about 35%. The writers tested 25 kinds of different pipes. The results were as follows:

1. Heat emission depends greatly upon the difference between the inside and outside temperatures. With increasing temperature difference the heat emission increases more than with direct proportionality. Between temperature difference of 36° and 250° F. and at the outside temperature of 68° F. the heat emission is proportional to the difference in 1.25 power.

2. The relation between heat emission, barometric pressure and temperature difference is given by the formula

$$Q_{tb} = Q_n \, (S + (1 - S) \sqrt{b/760}) \, (t/80)^{5/4}$$

where Q_n = heat emission at 144° F. temperature difference and one atmosphere pressure; Q_{tb} = heat

transmission at temperature difference t and barometric pressure b; S represents per cent of radiation (for fin tubes estimated at 25%), so that in the above formula S = 0.25. The formula is good for most conditions met in practice.

3. The amount of heat emitted per unit of weight of tube is a better basis for judgment about different kinds of fin tubes than the amount of heat emitted per square foot of total area.

4. The writers doubt whether it would be possible to represent heat emission for all kinds of tubes by one common formula because heat emission is influenced by many factors among which one of great influence is the quality of the contact between fin and tube. The better the contact is, the higher the amount of heat emitted.

5. The amount of heat emitted by steel fin tubes of 1.75 in. to 4.42 in. in diameter lies between 54.4 and 130 B.t.u. per lb. per hr. With decreasing diameter the heat emission increases.

6. The heat emission depends also upon the intervals between the fins. The following table shows this relation:

Diameter of Tube (Outside Dia. of tube body) Inches	Intervals between the Fins Inches	Heat Emitted B.t.u. per ft. per hr.	B.t.u. per lb. per hr.	B.t.u. per sq. ft. per °F. per hr.
3.03	4.77	1082	115	1.32
3.03	3.66	1130	102	1.14
2.98	3.03	1130	95.5	0.985

These figures are for 212° F. inside the tube and 68° F. air. From this table the writers conclude that it is incorrect to judge fin tubes by their heating surface.

7. The heat emission for cast iron tubes per unit of weight is only one-half of that for steel tubes.

8. As compared with usual smooth pipes, the emission coefficient (B.t.u. per sq. ft. per °F. per hr.) for fin tubes of same diameter is much smaller (about one-half), but the heat emission per unit of weight is considerably greater, being 1.3 to 2 times as great as for smooth pipes.

•

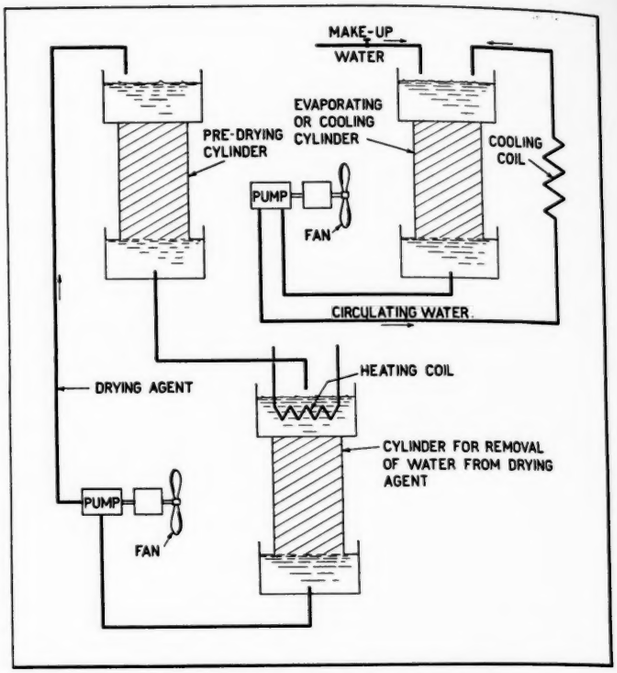
Cooling Air by Evaporation of Water with Previous Drying by Means of a Regenerable Absorber

From "Ventilateur refrigerant par evaporation partielle de l'eau avec absorber regenerable de l'humidite de l'air," by M. E. Guarini, Revue General du Froid, November, 1931; 5000 words.

ABSTRACTED BY A. A. BERESTNEFF

It is understood that the effectiveness of air cooling by evaporation of recirculated water, with which it is in contact, is dependent upon the relative humidity of the air, for a given dry bulb temperature. This cooling effect is increased as the relative humidity is decreased, and approaches zero when the air is near to saturation. Therefore, a greater cooling effect may be obtained by pre-drying the air, before evaporation takes place.

In this article, apparatus using the above principles of drying and cooling is described. A fan forces air through two cylinders, having large porous surfaces. In the first of these cylinders it comes in contact with some drying agent, such as calcium chloride or sulphuric acid, which absorbs moisture from it. The air is then passed into the cylinder through which the water to be cooled is circulated. Evaporation of a part of this water cools the remainder of the water, and the evaporation rate is increased, due to the lowered humidity of the air. A pump, shown connected to the fan motor, circulates the water through the cooling coil and evaporating cylinder.



Apparatus for drying and cooling

Water is removed from the drying agent in a third porous cylinder, into which it is circulated by a pump. Before entering the cylinder, it is heated by means of a coil, and a stream of air passing through it carries away much of the moisture.

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Heat Insulation by Air Spaces

From "Der Waermeschutz von Luftschichten", by W. Mull and H. Reiher, Beihefte zum Gesundheits-Ingenieur, Reihe I, Heft 28; 26 pages.

ABSTRACTED BY A. A. BERESTNEFF

Air spaces of thicknesses from about 0.4 in. to 8 in. (1 to 20 cm.) were investigated. They were tested in horizontal and vertical position and at an angle of 45° with the horizontal. The relation between the insulating capacity of the air spaces and two other factors, namely, (a) temperature difference between cold and warm limiting surfaces, and (b) the mean temperature of the air spaces, were also investigated.

Considering two ways in which heat transmission through the air space occurs, the writers come to the conclusion that while heat transmission by radiation can be easily determined with sufficient accuracy by means of the Stefan-Boltzmann law, the determination of heat transmission by conduction is difficult because the process is complicated by convection. The transmission of heat by these two latter methods combined, according to the writers, can be expressed by the formula

$$Q_c = \frac{a}{b}(t_1 - t_2) \times S$$

where a is an "apparent" or "equivalent" coefficient of heat transmission by conduction and convection expressed in B.t.u. per sq. ft. per in. per °F. per hr. The coefficient a is not a constant, however, and its value depends materially upon many factors, among which the thickness of air spaces, b, has a great influence. The purpose of the investigation was to find values of a for different conditions. Evidently knowing a for any particular case we can determine the heat transmitted by radiation and Q_c and find the total heat transmitted. Unfortunately, the form in which the numerical results are expressed does not permit presenting them in this abstract.

The conclusions drawn by the writers are:

1. The insulating capacity of air spaces depends materially upon (a) emission coefficient of both surfaces, (b) mean temperature of air space, (c) temperature difference, (d) thickness of air space, (e) height of spaces (if vertical).
2. The insulating capacity of air spaces does not increase infinitely with increase of thickness but it approaches a certain maximum value which is independent of the thickness.
3. The insulating capacity of an air space can be considerably improved by dividing its thickness, so that a space divided in four parts will improve in insulating capacity almost four times.
4. For temperature conditions as they exist inside living rooms the best insulation capacity for a vertical air space (undivided) will be obtained at a thickness of space of about 2 in. (5 cm.). The insulating capacity of horizontal spaces (warm surface underneath) remains nearly constant for all thicknesses between 2 in. and 8 in. (5-20 cm.).

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Heating and Ventilating of Schools

From: (1) "Die Heizung von Schulgebaeuden." Beiheft zum Gesundheits-Ingenieur, No. 29, 1931, by Prof. Chr. Eberle and Dr.-Ing. W. Raiss, and (2) "Schullueftungsanlagen", Beiheft zum Gesundheits-Ingenieur, No. 30, 1931, by Dr.-Ing. W. Reif; 56 pages.

ABSTRACTED BY A. A. BERESTNEFF

According to these two papers, the present German standards on heating and ventilating of schools are as follows:

The optimum temperature as recommended by different authors lies between 64.4° F. and 68° F. At the beginning of classes about 4° F. lower temperature should be maintained. The optimum value of relative humidity of air lies, generally speaking, between 30% and 70%. Some authorities, however, do not recommend the fluctuation of relative humidity in such large limits and call for a minimum humidity of 50%.

As to the amount of fresh air necessary for ventilation, no definite requirements by state regulations are mentioned in either of these bulletins. According to one authority on the field of heating and ventilation, the amount of fresh air necessary is between 9 and 15 c.f.m. per pupil.

Concerning the air velocity in the room, it is recommended that: (1) no cold air comes in direct touch with the people in the room, the cold air to be previously heated to the temperature of the room; and (2) the velocity for entering air to be 100 to 200 ft. per min.

The following interesting commentary is to be noted: In the opinion of some authorities, investigations and experiments made with the kata-thermometer up to now are not sufficient[1] to recommend this instrument for general use when determining or checking the conditions of best comfort. Instead, it is considered better to use each of the three factors—temperature, humidity and air motion—separately.

Heating systems at the schools investigated in the Bulletin (1) were: (a) 13 by low pressure steam (b) 4 by gravity hot water and (c) 2 by a combined hot water and oven system. In two cases, gas was used as the fuel.

In Germany, heating effect is sometimes expressed by the ratio *heat input* : *heat loss*. This value, as measured by the writers for the investigated schools, was found to be between 1.2 and 2.5. When these ratios were obtained, the heat loss was calculated on the basis of required optimum temperature (which in the case of these investigations was equal to 62.2° F.[2]). Everything above this temperature is considered as a loss of heat.

Another way to calculate the ratio is to consider the whole heat loss at any inside temperature as an actual loss. In this case, the ratio *heat input* : *heat loss* is smaller than before since, as a general rule, schoolrooms are overheated. This ratio is called a "thermal heating effect" and the difference between both ratios shows to what extent the rooms are overheated. For the same schools, the authors found the thermal heating effect to be from 1.5 to 1.7, with 1.3 for the gas-heated buildings only. Comparing with the value given for simple "heating effect" we see that the rooms are mostly overheated.

Results obtained in the Bulletin (2), are of particular interest. Various kinds of school ventilating systems were investigated, viz.: (1) simple natural ventilation using windows, (2) natural ventilation with exhaust ducts, (3) natural ventilation with entering air openings under the heating elements, (4) ventilation by centrally-heated air with exhaust ducts, (5) ventilation by simple warm-air system and (6) mechanical ventilation with centrifugal fans.

Mechanical ventilation gave the best results, although it did not eliminate all odors and resulted in air dryness. This latter demerit was, however, the subject of complaint by teachers in almost all the investigated schools. Especially dry air (h = 32-23%) was observed in one school with natural ventilation. Another complaint was "stagnation" of air in rooms ventilated by natural ventilation system without any exhaust ducts.

[1]The writer means, evidently, in Germany.

[2]It is lower than the optimum value given above for the same reason that we use 65° F. as an average value for day and night time when computing the number of degree days.

Correspondence

Cooling a Laboratory with Ice

EDITOR, HEATING AND VENTILATING:

As the article appearing in the November, 1931 issue of HEATING AND VENTILATING, describing the Boston and Maine Railroad Company's experiments in cooling a railroad coach by means of ice, may lead to the consideration of this method of cooling for other purposes, it may be of timely interest to point out that the Bell Telephone Laboratories have found a similar arrangement satisfactory for maintaining a test room at constant temperature.

This installation was very similar to that used by the railroad. The ice was kept in a well-insulated ice box opening at the top and having a capacity of about 700 lb. of broken ice. The usual drain outlet in the bottom of the box was provided with a valve that was normally kept closed and an overflow pipe was arranged to maintain about one foot of water in the box. This water was pumped through radiators of the copper fin type used for industrial steam heating purposes. From these radiators the water returned to the ice box where it was sprayed over the ice. The water was kept at a constant level in the ice box, the excess from the melting ice passing through the overflow pipe to the sewer. Due to dirt and sludge that accumulates from melting ice, it was necessary to include a strainer in the circulating system to prevent clogging of the radiators.

Three radiators connected in series were used, each with an air opening of approximately 200 sq. in. These were placed in a closed box with connection for drainage to take care of condensation. The air was recirculated through the radiators from the room by a duct system, which was arranged to admit a certain amount of fresh air to the room during the laboratory working hours. The blower was operated continuously, but the operation of the water pump was intermittent under control of a thermostat.

The room, which had a volume of approximately 5,800 cu. ft., was enclosed with brick and hollow tile walls, and had no special heat insulation other than storm sash at two windows having northern exposure. Also, due to the location of the room, it was necessary to place all of the equipment inside so that the cooling system had to take care of the energy dissipated by the ¾ hp. blower motor and the ¼ hp. pump motor. In addition, generally there were two people at work in this room during the day.

With this system it was possible to maintain a constant temperature of 70° in the room even during the hottest summer days. At such times, the ice consumption was approximately 3,000 lb. in 24 hr. The temperature of the cooling water entering the radiators was approximately 36° and that of the air leaving the radiators was approximately 45°.

The heat required for the room when the outside temperature was below 70° was furnished by hot water radiators under thermostatic control, but this part of the system was entirely independent of the cooling equipment.

This arrangement has been in successful use for over two years. However, the installation of a central refrigerating plant early in the past summer made possible the use of brine cooling coils in the chest where the ice was placed formerly. When this was done, the level of the water was raised to cover the coils.

Where a central refrigerating system is not available, the use of the arrangement described above has advantages from the standpoint of simplicity, low first cost and ease of maintenance. Practically the only attention required is the addition of ice periodically and an occasional cleaning of the equipment, both of which can be taken care of by unskilled labor.

J. C. WRIGHT
Member of Technical Staff
Bell Telephone Laboratories,
New York, N. Y.

Unit Fuel Consumption Higher for Certain Cities

EDITOR, HEATING AND VENTILATING:

Your *Degree-Day Handbook* seems to be in error in stating that the fuel consumption figures, given for conditions when the radiation is designed for maintaining 70° in zero weather, should be multiplied by a factor greater than unity for cities where the designed outside temperature is higher than zero degrees. It seems to me that in a city where heating systems are designed to maintain 70° in, for example, 10° extreme weather, the figure given in the *Handbook* should be multiplied by 6/7 and not by 7/6, as you give. Obviously, a southern city will have a lower fuel consumption than a northern one.

C. L. W.
Charleston, S. C.

At first glance the figures given in the "Handbook" *seem* to be in error. Perhaps the following will explain:

Assume two buildings exactly alike, one in Charleston, the other in New York. The latter building is designed for zero to 70° conditions, the Charleston building from 10° to 70° conditions. Assume that 7000 sq. ft. of steam radiation is placed in the New York building. Then, on the basis of designing for temperature, the southern building will require 6000 sq. ft. Now assume that on a certain day the temperature is 64° in New York, and also in Charleston. That day will have, consequently, one degree day.

Assume that this fuel consumption is 140 lb. of coal (this is a fictitious figure). The fuel consumption, consequently, per degree day is the same for both buildings. However, the amounts of fuel burned *per square foot* per degree day will differ. For the New York building, the coal burned per square foot per degree day will be

$$\frac{140}{7000 \times 1} = 0.02 \text{ lb.}$$

For the Charleston building, the figure will be

$$\frac{140}{6000 \times 1} = 0.0233 \text{ lb.}$$

Consequently, we find that the *unit* fuel consumption is greater for the southern building than the northern building.

News of the Month

Engineers to be on Equal Basis with Architects

On March 29, Governor Roosevelt signed bills passing the companion legislative measures, amending the Architect's Registration Law and the Engineer's License Law for New York State. Both laws have been strengthened, in an endeavor to eliminate misinterpretation, and to facilitate administration. Under the revised code, members of both professions are placed on an equal basis before a client, corporation, municipality, or the State, and either may accept a commission as principal, and retain the other on any project covered by the definitions set forth in the respective laws.

Amendment is yet to be made in the Multiple Dwelling Act, but it is predicted that the discrimination embodied in this act will be removed next year. Legislation to establish a code of ethics and practice is being advocated.

Rowley Visits Ontario Chapter

At the regular meeting of the Ontario chapter, A.S.H.V.E., held at Toronto, April 13, Barry Watson pointed out to the members that Toronto's present building by-laws are obsolete, as compared with modern practice in construction. According to Mr. Watson, a committee composed of members of the city architectural staff and such organizations as the Engineering Institute of Canada, has been appointed to revise these laws, and he proposed a motion, which carried, providing for an attempt on the part of the society to obtain representation on the committee.

President Rowley and A. V. Hutchinson, executive secretary of the society, were present, and addressed the meeting.

Hutchinson Tells of A. S. M. E. Work on Contaminated Air

"Engineering Responsibility in the Pure Air Problem" was the subject of an address delivered by Ely C. Hutchinson, editor of *Power*, and chairman of the A.S.M.E. pure air committee, to the Providence section of that society, April 5. In his discourse, Mr. Hutchinson included urban and street dusts and chemical fumes, as well as gases of combustion from stacks, among the sources of air contamination. He described the efforts of the A.S.M.E. to apply engineering methods of research, analysis, and evaluation to the conflicting evidence that has been presented on this subject, in an endeavor to secure uniform, cooperative and intelligent action.

Air Flow Discussed at Pacific Coast Meeting

A demonstration and lecture on the aeronautics wind tunnel of the California Institute of Technology, Pasadena, Calif., was presented by Arthur L. Klein, assistant professor of Aeronautics, at the meeting of the Southern California chapter, A. S. H. V. E., held April 11 under the auspices of the Institute. Raymond Ager, also of the engineering faculty of the Institute, demonstrated and explained the million volt transmission equipment in the laboratory.

About 250 members and guests were present.

Michigan Air Conditioning Course Well Attended

About 75 men attended the short course in air conditioning and forced air heating given at Michigan State College, East Lansing, Mich., March 22-24. That keen interest in the subject exists among the men in the industry was evidenced by the fact that seven states were represented among those enrolled.

Governor Vetoes School Ventilation Bill

The so-called Mastick bill, providing for the elimination of the 30 c.f.m. requirement in the school ventilation law of New York State, was vetoed by Governor Franklin D. Roosevelt, March 28. The bill, which called for the substitution of "proper ventilation" as the only requirement, underwent a similar experience last winter.

The Governor commented on the act as follows:

"I recognize the desirability of changing the present legal requirements which call for 30 cu. ft. of pure air every minute per pupil in new schools, because since this statute was written we know a great deal more about ventilation. Nevertheless, the present bill would substitute a mere requirement of 'proper ventilation' and would wholly eliminate the requirement of positive facilities, independent of atmospheric changes, for exhausting foul or vitiated air. I am inclined to think that some new standard other than the vague requirement of 'proper ventilation' should be set up and that there should still remain some positive requirement for the exhausting of foul or vitiated air from schoolrooms.

"I hope that during the balance of this year the Department of Education and the Department of Health can work out a change in the law which will meet this purpose. In the meantime, it is necessary to disapprove this bill because it might let down the bars too far."

British Heating Engineers Elect Cooling

J. W. Cooling was formally inducted into the office of president of the Institute of Heating and Ventilating Engineers, at the annual meeting of that organization, held February 10, in London. Mr. Cooling has been an active member of the council of the Institute since 1924 and is also an associate member of the Institute of Mechanical Engineers. He is the third member of the firm of J. Jeffreys and Company, Ltd., to become president of the Institute.

In his address, Mr. Cooling touched on the subject of radiant heating, citing the more complicated calculations necessary for its computation, as compared to those for convected heating. He predicted the widespread use of radiant heating in the future, both in England and America. Use of low temperature radiant heating, to take the chill off the room, in conjunction with high temperature radiation, to be switched

on for immediate warming upon occupancy, was considered.

The increased necessity of air conditioning, brought about by the closing of windows and doors against the noise of traffic and industry, formed a part of the discourse. Concluding, Mr. Cooling stressed the advisability of constant pursuit of technical knowledge, especially by the younger men engaged in heating and ventilating work, with emphasis on the study of advanced physics. Unrestrained exchange of ideas among engineers was advocated as a means of promoting the welfare of the industry.

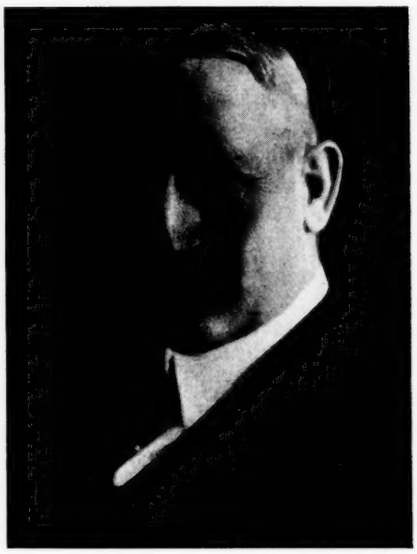
Committee reports revealed that 17 associate members and 13 graduates had passed the required examinations for membership. A summer meeting will be held at Folkestone, England, June 20-22.

Oil Burner Show and Convention Establishes Attendance Record

Giving a new national significance to the oil burner industry, the ninth annual oil burner convention and show, conducted by the American Oil Burner Association, closed in Boston April 16, after a week that established new attendance records for oil burner shows and a record-breaking registration in so far as the industry itself was concerned.

The show achieved a new public attendance record of more than 13,000 persons up to Saturday noon, and represented only one of the highlights of the convention which brought out a record dealer attendance, and names of national significance on the various business and entertainment programs. A tremendous ovation was given J. M. Curley, mayor of Boston, at the annual banquet on the night of April 14, when he told the association that Boston's record of being the cleanest city in the country was directly tied up with the fact that it was the oldest oil burner market in America. He pointed out that 140,000 tons of coal were replaced in the city institutions by the substitution of oil burners and declared that the oil burners had made the city independent of the coal industry in Pennsylvania. "We are largely indebted to you for a clean city," he asserted, "the oil burner solves the problem of dust and saves $50,000 a year to the city in the matter of the removal of ashes."

Mayor Curley's statement was in response to remarks of toastmaster Edward P. Bailey, of the National Airoil Burner Company, who reported that a survey recently made in 24 principal cities disclosed that Boston had the lowest dust count per cubic foot. Other persons heard from during the course of the week's business sessions included Ralph B. Wilson, vice-president of Babson's Statistical Organization; Katharine A. Fisher, director of the Good Housekeeping Institute; R. M. Sherman, president of the Silent Glow Oil Burner Corporation; Walt S. Goodwin, New York sales consultant; E. V. Walsh, general sales manager of the Timken Silent Automatic Company; B. K. Breed, commercial and industrial sales engineer of the Preferred Utilities Company; Walter F. Tant; Rudolf Neuburger, merchandising consultant of the Zapon Company; C. F. Cornelssen, manager retail division, May Oil Burner Corporation; John H. McIlvaine, president of the McIlvaine Burner Corporation; Joseph R. Murphy, general sales manager of Taco Heaters, Incorporated; Vincent S. Day, chief engineer, Carrier-Lyle Corporation; R. G. Bookhout, editor, *Plumbing and Heating Contractors Trade Journal;* Robert Tinsman, president, Federal Advertising Agency, and Professor L. E. Seeley, Sheffield Scientific School, Yale University.



Morgan J. Hammers, newly elected president, A.O.B.A.

Running through the addresses was a note of optimism, together with the admonition that industry and a full understanding of the complete markets available would mean more than an ordinary measure of prosperity for the oil burner business. The immediate and potential market was clearly visualized for the convention by Mr. Wilson, who said there was an immediate market in 3,000,000 homes and that the industry could count on a normal expansion of demand of at least 200,000 homes a year.

In addition to receiving the annual report from Walter F. Tant, retiring president of the association, the directorate took a vigorous stand against federal extravagance and demanded that every effort be made in Washington to cut down expenditures. In dealing with this aspect of its business, the board reaffirmed its vigorous objections to the excise oil tax.

The board also received a program of trade practices for the industry and set up an advertising code, the purpose of which is to raise the standard of advertising through the elimination of unethical and disparaging copy and through positive statements rather than negative, to sell the industry as a stable, responsible, fully-established industry. Mr. Tant, in his annual report to the board, revealed the many activities of the association during the past year and reported that the dealer division membership increased from 144 to 2383 members and that the individual division membership had increased from 9 to 49 members.

Morgan J. Hammers, vice-president and general manager of the Petroleum Heat and Power Company, was elected president, succeeding Walter F. Tant. The executive committee elected includes Morgan J. Hammers, Haldeman Finnie of the Timken Silent Automatic Company; E. M. Fleischmann

of the May Oil Burner Corporation; W. J. Smith of the Cleveland Steel Products Corporation, and R. M. Sherman of the Silent Glow Oil Burner Corporation. Of the foregoing the following were named vice-presidents of the association: Messrs. Finnie, Smith, and Sherman. R. S. Bohn of the Preferred Utilities Manufacturing Company, who was named chairman of the dealer division succeeding Lionel L. Jacobs, also was named vice-president, as was J. H. Hirsch of the Automatic Burner Corporation. To fill vacancies on the board of directors from the manufacturers' division, the following two men were elected: Robert Hoffman, president of the York Oil Burner Company, and J. A. Lattner, secretary-treasurer of the Century Engineering Corporation. To fill vacancies from the dealer division, the following were elected to the directorate: George Steele, Automatic Utilities Inc., and John W. Scott, Buckley and Scott Utilities Company.

Mr. Tant was elected a life-time honorary member of the American Oil Burner Association.

House Bill Proposed to Separate Heating on Federal Projects

Hearings on the Carley bill, (H. R. 9975) pertaining to contracts for erection and alteration of public buildings, were held before the House Committee on Public Buildings and Grounds, April 7 and 8. The bill requires that every Federal agency, in projecting work involving the expenditure of and in excess of $1000 for installation of plumbing and fitting, steam and hot water heating, and electrical equipment, shall make separate plans and award separate contracts for the work. Representatives of the Electrical Guild of North America, Heating and Piping Contractors National Association, and National Association of Master Plumbers, presented arguments in favor of the bill at the hearing.

Among the benefits to both the Government and the industries involved, cited by the proponents of the bill, were: elimination of the brokerage fees charged by the general contractor on the installation of mechanical equipment; improved quality of work, resulting from the Government dealing directly with the contractor responsible for the mechanical equipment, and the award of contracts to specialists competent to install complicated equipment, and simplification of the credit problems of the industries, by substituting the Government's credit for that of the general contractor. The bill, in its present wording, follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that every department or board, bureau, commission, body, or person charged with the duty of preparing plans, specifications, and blueprints for the erection, alteration, or repair of any building in any State or Territory or in the District of Columbia, by the United States, and every officer or person designated by such department, or board, or bureau, or commission, or body to act for it and in its stead, and charged with the duty of preparing such plans, specifications, and blueprints, which shall provide for the installation of plumbing and gas fitting and all work kindred thereto, or of the steam and hot water heating, ventilating apparatus, steam-power plant and all work kindred thereto, or the electrical equipment and all work kindred thereto, shall, when the entire cost of the erection, alteration, or repair of the plumbing and gas fitting and all work kindred thereto, or the steam and hot water heating, ventilating apparatus, steam-power plant and all work kindred thereto, or the electrical equipment and all work kindred thereto, is to exceed the sum of $1,000, hereafter prepare separate plans, specifications, and blueprints for each of the following branches or classes of the work to be performed:

First. Plumbing and gas fitting, and all work kindred thereto;

Second. Steam and hot water heating, ventilating apparatus, steam-power plant, and work kindred thereto; and

Third. Electrical equipment, and all work kindred thereto.

Such plans, specifications, and blueprints must be so prepared and drawn as to permit separate and independent proposals and bids upon each of the branches or classes of work in the three above subdivisions.

Sec. 2. That every department, or board, or bureau, or commission, or body, or person charged with the duty of awarding or entering into contracts for the erection, alteration, or repair of any building in any State or Territory or in the District of Columbia, by the United States, and every officer or person designated by such department or board, or bureau, or commission, or body to act for it and in its stead, and charged with the duty and duly empowered to award and enter into such contracts, which shall provide for the installation of plumbing and gas fitting and all work kindred thereto, or the steam and hot water heating, ventilating apparatus, steam-power plant, and all work kindred thereto, or the electrical equipment and all work kindred thereto, shall, when the entire cost of the erection, alteration, or repair of the plumbing and gas fitting and all work kindred thereto, or the steam and hot water heating, ventilating apparatus, steam-power plant, and all work kindred thereto, is to exceed the sum of $1,000, hereafter award the respective work specified in the subdivisions mentioned in section one hereof separately to responsible and reliable individuals, firms, or corporations.

Sec. 3. That all Acts and parts of Acts in conflict with the provisions of this Act are hereby repealed.

Sec. 4. That this Act shall take effect and be in force —— days after the date of its enactment.

Empire State Contractors Urged to Support Carley Bill

Concentration on merchandising, in an effort to promote both modernization and new contract work, and support for the Carley bill, providing for the separation of mechanical equipment awards from general contracts on public works construction, were advocated at the thirty-seventh annual meeting of the Heating and Piping Contractors New York State Association, held in New York, April 4.

S. Lewis Land, educational director of the association, stated that remodeling offers the most practical field for heating contractors to exploit in seeking business. He suggested that contractors maintain a contact with fuel companies to obtain the names of homeowners who are complaining about difficulties with their heating.

News of the Month

Renewed efforts to obtain a law requiring that heating contractors be registered was urged by William E. Taylor, in spite of the defeat of the measure in the last session of the state legislature due to faulty wording. In advocating support of the Carley bill, W. J. Olvany, president of the association, cited the success of a like measure, separating mechanical contracts from the general contracts in state, county, and municipal work in New York State.

E. W. Tompkins, Albany, N. Y., was elected president of the association, and other officers chosen were: vice-president, E. H. Johnston, New York; secretary-treasurer, Raymond Niles, Albany; recording secretary, Emerson J. Leary, Buffalo; directors, W. J. Olvany, New York; T. X. Donovan, Syracuse; Edward B. Folley, Binghampton; John W. Hickey, Olean; Paul W. Schneider, Utica; and Martin W. Utz, Rochester.

Trailers Supply Steam Heat to Electric Railroad Cars

For supplying steam for heating passenger cars in trains hauled by electric locomotives between Grand Central and Harmon, where no provision is made for accomplishing this in the electric locomotive, or where that provision is inadequate, the New York Central Railroad has recently placed in service eight trailers carrying oil-fired heating boilers. By connecting one of these trailers to the locomotive, the railroad can use freight locomotives for passenger service, and also make possible the heating of longer trains than can be supplied by the passenger engines.

Trailers carry only heating apparatus, are 30 ft. long, and weigh 50 tons. They have a capacity of 215 gal. of fuel oil, and 1200 gal. of water, and will supply sufficient steam at 155 lb. pressure to heat 22 cars.

War Department Is Government's Chief Fuel User

According to an information circular distributed by the Department of Commerce, Bureau of Mines, the Federal Government consumed during the fiscal year of 1930, 3,025,279 tons of bituminous coal; 156,384 tons of anthracite; 8,456,377 gal. of furnace oil; 16,238,145 bbl. of fuel oil, and 2,918,214,000 cu. ft. of natural and manufactured gas, the majority of which can be allocated to the functions of the War and Navy Departments. This does not include relatively small quantities of coke, wood, kerosene, charcoal, and other items on the Government's fuel bill for that period.

Chief users of anthracite were the War Department, Treasury Department, and Veterans' Administration. The War, Navy, and Commerce Departments were the most important users of bituminous coal, in the order named. Most of the furnace oil was consumed by the War Department, with the Post Office and Treasury Departments next in the amount used. Fuel oil was used chiefly in the ships of the Shipping Board, and the War and Navy Departments. The War Department consumed 67% of the total gas burned by the Government.

Portable boiler room for steam heating passenger trains in New York suburban territory. Photo by Ewing Galloway.

Power Boilers and Heating Discussed at Philadelphia

An illustrated lecture, "The Design of Power Boilers and Their Application to Heating Systems," was brought to the Philadelphia chapter, A.S.H.V.E., at its regular meeting, April 14, by George Bach, of the Union Iron Works, Erie, Pa. Preceding Mr. Bach's talk, a film on the subject of "The Manufacture of Fire Brick and Refractories," prepared by the Harbison-Walker Refractory Company, was exhibited.

Furnace Manufacturers to Hold Convention May 18-19

Discussions of costs and credits by manufacturers; of research, by Professors Willard and Kratz of the University of Illinois; of gas heating, by Professor Leckie of Purdue University, and other important papers will feature the May convention of the National Warm Air Heating Association to be held at the Deshler-Wallick Hotel, Columbus, Ohio, May 18-19.

The program follows:

MAY 18

10 a.m.—Observations, I. L. Jones, president. The Present Problems and Future Opportunities of Our Industry, A. W. Wrieden, Holland, Mich. Credits—Manufacturer and Heating Contractor, L. B. Murphy, Cincinnati, Ohio. Costs and Selling Expenses for the Manufacturer and Dealer, W. L. Rybolt, Ashland, Ohio.

2 p.m.—Research Advisory Committee Report, F. G. Sedgwick, chairman. Presentation of Recent Developments from Our Research Work, A. C. Willard, professor of heating and ventilation, University of Illinois; A. P. Kratz, research professor of mechanical engineering; S. Konzo, research assistant.

7 p.m.—Buffet Supper and Smoker, Crystal Ballroom, Deshler-Wallick Hotel.

MAY 19

9:30 a.m.—Air Pollution and Its Relation to Community Health, H. C. Murphy, Louisville, Ky. The Use of Gaseous Fuels in Home Heating, R. B. Leckie, professor gas engineering, Purdue University. Keeping Cool, F. Paul Anderson, Dean, College of Engineering, University of Kentucky. The Opportunity for Successful Dealer Activities, B. L. Schwartz, Pittsburgh, Pa.

1:30 p.m.—Reports of Officers and Committees: Code, Trade Relations, Membership, Public Information, Credit, Traffic, and other committees. New and Unfinished Business.

New Jersey Gas Men Publish Heating Manual

At the annual convention of the New Jersey Gas Association, held in Newark, N. J., March 30, H. P. Morehouse, chairman, industrial and house-heating committee, reviewed the "Engineering Handbook for Building Heating by Gas,"* recently published. The book is intended to simplify the engineering aspect of the sales problem, having all of the technical data which the house-heating engineer might need assembled in one volume, sufficiently compact to fit into the salesman's pocket for use in the field.

Ice Industry Prepares to Exploit Comfort Cooling

Widespread interest throughout the ice industry in the application of ice to air conditioning and comfort cooling, is evidenced by the attention accorded the subject in the form of addresses and technical papers delivered at conventions of the industry in several sections of the country. Indications point to a concentration of effort on the part of ice manufacturers and dealers to develop this field during the coming season.

R. H. Beck, Seattle, Wash., presented a paper at the thirteenth annual convention of the Northwest Association of Ice Industries, held in Victoria, B. C., February 22-23, entitled "Air Conditioning with Ice—What It Means to the Ice Industry," in which he described the kinds of equipment usually used for this purpose. Mr. Beck stressed the importance of correct insulation in the plant, and advocated the air washer type of cooler, as superior to the dry coil variety. He concluded with a comparison, from the economic standpoint, of ice versus mechanical refrigeration for this purpose. Mr. Beck's discourse was followed by a discussion of the commercial aspect of the case, by F. L. Croteau of Spokane, Wash.

At the Mountain States Association's convention, Salt Lake City, Utah, February 18-20, H. L. Froese, manager of the Denver branch of the York Ice Machinery Corporation, delivered a non-technical address on space and comfort cooling, in which he urged ice dealers to get into the field while it is a new one.

D. M. Leslie, Salina, Kans., talked on "Space Cooling in Small Shops and Offices" at the convention of the Indiana Association, held at Indianapolis, February 24-25. Mr. Leslie advocated the financial support of the National Association for research work on the problem in its technical department.

Members of the Pennsylvania Ice Producers' Association, at its fourteenth annual meeting, held in Philadelphia, March 16-17, heard an address by T. J. Atkins of the Carrier-York Corporation, on the subject of "Cooperation and Service from the Air Conditioning Engineer." He described the research work carried on by his organization, and described the development of the use of ice on a large scale in air conditioning.

The subject was likewise taken up and studied at meetings of the New England Association, and the newly-organized Iowa Association.

Research Residence Activities Outlined for 1932

A program of research activities, to include investigations into all phases of forced air heating, has been announced by the University of Illlnois, Urbana, Ill., and the National Warm Air Heating Association.

*To be abstracted in HEATING AND VENTILATING next month.

News of the Month

Air filters will be studied, the system being operated first with no filters, to determine the static pressure loss, then with clean filters and, finally, with dust-laden filters, to determine the drop in head resulting from resistance to flow. The amount of resistance caused by the installation of an air washer, installed in the bonnet of the system, and the degree of humidification obtainable, will also be investigated.

Overall house-heating efficiency and fuel consumption of the furnace will be obtained under actual operating conditions. The performance characteristics of the furnace, and distribution of air temperatures in the furnace bonnet, are to be determined for continuous operation for various bonnet heights and arrangements of baffling in the furnace casing. Different sizes of the present type of furnace will be tested, in an attempt to establish some simple basis by which the minimum size of furnace required for forced air heating may be determined. Similar tests, to be conducted on steel furnaces, have been recommended.

Ducts and registers will be studied as directed in the outline of procedure, and the individual duct system will be investigated at the completion of the present work on the trunk duct system. Maximum tip speed and outlet velocity for blowers to obtain freedom from noticeable air noise will be determined.

Methods for elimination of stratification are to be studied, with a view to selection and location of control equipment. Work on summer cooling is to be started this summer. Tests on heating loads in individual rooms, insulation materials and methods, and a study of plans and layouts for forced air equipment and installation, are under consideration.

Central Supply Foresees Improvement in Industry

A note of optimism was struck at the meeting of the Central Supply Association, held in Chicago, April 6-7, when several of the

industry's leading executives expressed opinions that the heating and plumbing industry will, in the not distant future, come out of the slump. None of them anticipate an immediate increase in business, but they do believe that the worst of the depression is over, and that the application of sound business methods, combined with intelligent and aggressive sales efforts, is the surest way of hastening improvement.

Speakers were confined to leaders in the plumbing and heating industry, who are more familiar with the specific problems of that business. W. E. Price, Knapp Supply Co., Muncie, Ind., described a campaign carried out successfully in Muncie, to stimulate activity in the building industry in that city. Mr. Price emphasized the necessity for cooperation between the various branches of the construction industry to successfully carry out such a plan.

A report on "The Strength of the Trade Practice Rules" was rendered by E. I. Leighton, Leighton Supply Co., Fort Dodge, Iowa, in which he outlined various revisions since their approval by the Federal Trade Commission in 1929.

Bid Thine Own Braziers

By Ab El Pilauf

WAZIR, the brazier maker, and El Ther Mal, who also made braziers, were seated before the bazaar of Wazir.

"Effendi, thou hast been summoned to quote Haroun the camel trader on the braziers for his new maternity tent for camels?" Wazir questioned, fixing his beady black eyes on El Ther Mal, who seemed ill at ease.

"Yea, I have received such summons," answered El Ther Mal, hesitatingly.

"Dost thou think that thou canst build braziers that will help a pup camel to health and strength?" asked Wazir, smilingly. "Thou knowest thy reputation,—that thy braziers are but cans upon four legs that smoke offensively, and smell like unto a heap of offal."

"Mine enemies hast well nigh ruined me with this slander," said El Ther Mal, miserably.

Wazir regarded him with compassion. "I have a plan that shalt put shekels in thy purse."

El Ther Mal brightened with interest. "In my purse didst thou say? What plot hast thou, that wilt put specie in my clutches?"

"Listen closely," said Wazir. "Thou wilt quote Haroun on the braziers. Mayhap thy bid wilt be low, but it wilt avail thee not. Haroun wilt show me thy bid, and I shalt take this job at thy price. Now, here is my scheme. I shalt give Haroun my bid, with a profit in it for me and also a cut for thee. Then, I shalt give thee a bid that thou shalt give Haroun, that shalt be higher than mine. In this manner thou getest something, whilst thy way thou getest nothing."

AB EL PILAUF

New Dehumidifying Compound Discovered

A chemical compound, said to have properties which make it valuable as a dehumidifier in air conditioning processes, has been developed in the metallurgical laboratory of the Peoples Gas Light & Coke Co., Chicago, under the supervision of Robert G. Guthrie, chief metallurgist, and Dr. Oscar J. Wilbor, research chemist. The material has been named lamisilite by its discoverers, because of its laminated structure and siliceous nature.

Lamisilite can be produced at low cost, and a small amount of it is as effective as much larger amounts of the materials now in use, it is claimed, which makes possible a reduction in size of the apparatus. The actual composition of the compound has not been revealed.

Air from the rooms is drawn first through a spray of water, where dust and odors are removed, and then passed over a bed of lamisilite, from which it is delivered cool, dry, and odorless. After it has become saturated, the material is dried out by the application of heat from a gas flame.

Campaign for Home Remodeling Extended

Home modernizing campaigns in operation in 92 cities and contemplated in 142 others will result in expenditure of about $25,000,000 for labor and materials by the end of June, according to information made available by the committee on reconditioning, remodeling, and modernizing of the Department of Commerce, Washington, D. C. The function of the committee is to assist homeowners, local organizations, and all persons or groups interested in home improvement by means of educational activities.

A home inspection list, which outlines a method of checking up on possible improvements, has been prepared, and periodic inspection is suggested as a means of offsetting depreciation, improving appearance, and increasing the value of homes. Campaigns of outstanding success have been carried on in Muncie, Ind., Pawtucket, R. I., and Greensboro, N. C.

House Subcommittee Acts Favorably on Home Loan Bill

A subcommittee of the committee

on banking in the House of Representatives agreed on April 19, by a vote of 4 to 1, to report favorably to the full committee on the Luce bill (H. R. 7620) authorizing an appropriation of $150,000,000 to create Federal home loan funds, and to provide for their supervision. Representative Reilly, chairman of the subcommittee investigating the matter, said he would ask for immediate consideration of the measure by the full committee, and would also seek to have the bill brought before the House for action as soon as possible.

Initial capitalization of $150,000,000 would be distributed among 12 banks, one in each of the Federal Reserve districts, and the banks themselves would be required to raise a corresponding sum. Proponents of the bill believe that its successful passage would stimulate building. A companion bill before the Senate banking committee has not been acted upon.

Air Conditioned Sleeping Car Trains Inaugurated in East

With the placing in service on April 21 of air conditioned equipment on the *National Limited*, a through sleeping car train operating between New York, Washington, Cincinnati, Louisville, and St. Louis, the Baltimore and Ohio Railroad won a race it has been staging with the Chesapeake and Ohio Railroad. A few days later, on April 24, the C. & O. put the *George Washington*, similarly equipped, into service between, or connecting with, the same points.

These are the first long distance trains in the east to carry air conditioned Pullman sleeping cars, and observation and lounge cars. During the past summer, the Santa Fe *Chief* carried air conditioned cars, and the B. & O. had about 40 such cars in service between New York and Washington. Railroad men predict that about 200 air conditioned cars will be put into operation this summer.

"Selah!" said El Ther Mal, admiringly. "Truly thy skull containeth something other than scrambled camel-radish."

El Ther Mal returned to his own bazaar and rejoiced with his offspring. "At last," quoth he, "I have learned a way to beat this racket." And he gloated avariciously at the thought of the shekels soon to fall in his lap.

Presently, a messenger brought him a parchment from Wazir, on which was writ the bid of El Ther Mal on the braziers to Haroun.

Putting on his oldest garment, he went to Haroun and said: "Here is the bid on thy braziers, as thou requested. I have slit my profit, forsooth, because I must have this job that my brood may eat." And pulling a long visage, he stood, supplicating.

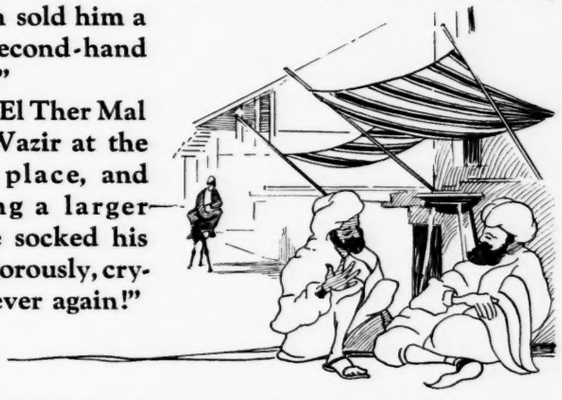
"Go thy way in peace and expectation," said Haroun, "and I shalt do my stuff, that thou may have this contract."

El Ther Mal departed, his face wreathed in a broad grin.

At sundown of the third day he sought Wazir, and found him at the wailing place, caressing his brow with a rock and moaning. When El Ther Mal asked him for the cut that was coming to him, Wazir groaned.

"A descendant of a viper hath betrayed me. Mak Troob, the charcoal burner, hath rode his ass in haste to the tent of Haroun one hour before the bids closed, and hath sold him a lot of second-hand braziers."

Then El Ther Mal joined Wazir at the wailing place, and grabbing a larger rock, he socked his skull, vigorously, crying, "Never again!"



House Insulation Discussed Before Illinois Chapter

A paper discussing the latest developments in house insulation was presented by H. J. Schweim, chief engineer of the Gypsum Association, at the April meeting of the Illinois chapter, A.S.H.V.E., in Chicago, April 11. M. A. Smith, engineering sales manager, United States Gypsum Company, also addressed the meeting, his subject being "Architectural Acoustics and the Isolation of Machinery Noises from Structures."

A discussion of the Hartford loop connection by R. E. Hattis, consulting engineer, Chicago, and exhibition of four reels of motion pictures entitled "From Coal to Electricity" were included in the program.

A resolution in memory of George H. Kirk, prominent heating contractor of Chicago, and William B. Crawford, combustion engineer, Seneca Petroleum Company, both of whom died during the month, was read into the minutes of the society.

Tenney Describes Water System in Skyscraper

A lecture describing the hot water convection heating system in the new 63-story Cities Service Building, New York, was presented to the New York chapter, A.S.H.V.E., at the regular meeting on April 18, by T. S. Tenney, of Tenney & Ohms, consulting engineers.

The talk was illustrated with slides, showing the installation layout. Mr. Tenney outlined the advantages of hot water heating for this kind of construction, and his audience responded with a number of questions in the discussion that followed.

News of the Month

Louis T. M. Ralston, consulting engineer was elected president of the chapter for the coming year.

President Rowley Visits Chapters During April

Prof. F. B. Rowley, president of the A.S.H.V.E., made his official visit to the Pittsburgh chapter April 11, the Western New York chapter, Buffalo, April 12, and the Ontario chapter, Toronto, April 13. April 14-15 he visited the Michigan chapters at Detroit and Grand Rapids. Members of the committee on research, and the council of the society assembled in Pittsburgh April 8-9.

Heating Demand Increases in March

Although the total degree days for the heating season from September 1 to March 31 remain far below the total for that period in normal years, unusually severe weather during March, especially in the central states, brought the degree days for that month considerably above the normal figure. Tabulated below are the number of degree days up to the end of March, for this season, compared with the normal for the corresponding period, in five cities. The amount by which the degree days for March, 1932 exceeded the normal, expressed in per cent, is also shown.

At New York and Boston, the temperature for March averaged close to normal, but the hourly mean temperature, for 24 hours, was 6° colder than that for January. The barometer was higher than normal during the warm weather of January, but during March it was 0.28 in. below normal, which is close to the record low. This made March the windiest month in 62 years in New York.

Jean Borotra (left), managing director, Cie D'Applications Techniques, reported to be the largest oil burner manufacturer in France (C.A.T. burner), recently arrived in New York. Before his connection with the oil burner industry, M. Borotra was known as one of the four tennis musketeers of France, and was a member of the French Davis cup team. He is shown above with Irene Bordoni, French actress, during a recent International Doubles Championship. While in New York, M. Borotra lost his title in the National Indoor Tennis Tournament, held in March. Photo by International Newsreel.

In the interior, the coldest weather of the winter obtained, the departure from normal at Chicago, St. Louis, and Pittsburgh averaging 23° below the daily normal for the eight days March 6-14.

Michigan Ice Dealers Discuss Comfort Conditioning

At its fifteenth annual convention, held in Detroit, March 22-23, the Michigan Ice Industries Association heard a paper entitled "Comfort Cooling and Its Possibilities" by A. G. Loeffel, Detroit City Service Company, who illustrated his discourse with lantern slides, showing charts and results of tests of mechanical and ice equipment.

Mr. Loeffel urged that salesmen of ice comfort cooling apparatus simplify their presentations of the facts and theory of the problem to the prospective buyers as much as possible, as the public will more readily accept plain statements that it can understand.

In a brief talk following Mr. Loeffel's discussion, George Steers, Kalamazoo Ice and Fuel Company, pointed out that comfort cooling is more a merchandising problem than a technical one.

Sterling S. Sanford, Detroit Edison Company, spoke on "What the Power Company Thinks of Comfort Cooling," in which he outlined the potential market in the surrounding territory. He also described research and investigations carried on by his company along these lines, and of the publicity it has given the various types of comfort cooling equipment.

Bulletin on Fireplaces Issued by Committee of Ten

Educational Bulletin No. 2, devoted to fireplace construction, has been issued by the Committee of Ten, Coal and Heating Industries, Chicago, Ill. Theory of correct construction is discussed in four pages of text, and a page of illustrations is included. Copies may be obtained from the Committee of Ten at 10 cents each.

Consulting Engineers Urged to Register

Engineers' registration laws are at present in effect in 28 states, in which are located over 80% of the engineers of this country, and all professional engineers are strongly advised, in their own interests, to enroll for registration as soon as possible, according to an announcement from D. B. Steinman, president, National Council of State Boards of Engineering Examiners. Over 35,000 engineers have already been registered, including 10,000 in New York, and 6000 in California.

Enforcement measures have already been put into operation, and men have been arrested, tried, and fined for practicing without license.

DEGREE DAYS—SEPTEMBER TO MARCH—FIVE CITIES

	Degree Days September 1 to March 31 this season	Degree Days September 1 to March 31 normal year	Per Cent this year below normal	Per Cent above normal March, 1932
New York	3753	4707	20.2	3.2
Boston	4367	5230	16.5	—
Pittsburgh	3922	4734	17.1	23.1
Chicago	4467	5518	19.1	18.9
St. Louis	3287	4309	23.7	23.0

The courts have ruled that a contract for engineering services is invalid if the party undertaking to furnish such services is not registered, and the courts have repeatedly dismissed actions for collection of fees by unlicensed engineers. There is a case on record of a manslaughter conviction, resulting from a fatality when a structure failed that had been designed by a man without license to practice.

Labor Survey on Program of Contractors' Convention

Due to the recent and pending wage adjustments, a survey of labor conditions in the industry will assume particular importance among the features on the program of the forty-third annual convention of the Heating and Piping Contractors National Association, to be held in Detroit, Mich., May 16-18.

This survey, made semi-annually by the association, together with the third survey of the heating industry, to be presented by Joseph C. Fitts, national secretary, is expected to give a comprehensive cross-section of operating conditions in the heating field.

Convention headquarters will be at the Book-Cadillac Hotel, where sessions will be held. Entertainment for both the delegates and women have been planned. The program follows:

MAY 16

9 a.m.—Registration of Delegates and Guests. Board of Directors Meeting—Founders Room. Association Managers' and Secretaries' Conference.

2 p.m.—Address of Welcome, Hon. Frank Murphy, Mayor of Detroit. Welcome to Detroit, George Freyn, chairman of Detroit convention committee. President's Address, Ray L. Spitzley. Report of Treasurer, J. Lawrence DeNeille. Report of National Headquarters, Joseph C. Fitts, secretary. Report of Educational Department, S. Lewis Land, educatinal director. Report of Credential Committee. Report of Membership Committee, J. Lawrence DeNeille, chairman. Address — The Outlook for Business, Col. James L. Walsh, vice-president, Guardian Detroit Union Group.

MAY 17

9 a.m.—Papers by Secretaries of Local Associations. Discussion of Papers. Report of Committee on Standards, Richard A. Wolff, chairman. Report of Sub-Committee on Boiler Output, Harry M. Hart, chairman. Air Conditioning, Walter L. Fleisher. Report of Committee on Certified Heating, C. P. Finke, chairman. Report of Committee on Welding, John H. Zink, chairman.

2 p.m.—Report of Committee on Separation of Contracts, Robert D. Williams, chairman. Report of Committee on Trade Promotion, Walter Klie, chairman. Third Annual Survey of the Heating Industry, Joseph C. Fitts, secretary.

7 p.m.—Dinner Dance.

MAY 18

9 a.m.—Report of Convention Committees. Election of Officers. Unfinished Business. New Business.

Southern Gas Men to Discuss Air Conditioning

Included in the tentative program planned for the annual convention of the Southern Gas Association, to be held in New Orleans, May 3-5, are presentations of several papers on heating and air conditioning. At the first session of the technical section, a paper on "Burner Conversions" will be presented by C. L. Naire, of the New Orleans Public Service Company.

"Securing the House-Heating Load" is the title of a discussion to be led by J. F. Orr, of the United Gas Public Service Co., Houston, Tex., at the technical session. A paper on "Promoting Central Plant Heating" will be read by C. P. Balsam, of the Washington Gas Light Co., Washington, D. C., and E. D. Milener, of the American Gas Association, New York, N. Y., will speak on "What Air Conditioning Will Mean to the Gas Industry," at a meeting of the industrial section.

Discuss Heating and Ventilating of Aircraft Factory

Cost of heating the Western Aircraft Company's plant will be about

News of the Month

$7900 per year, according to John F. Tobin, chairman and one-man committee on heating and ventilating for the junior division of the Western Society of Engineers, before whom he discussed the subject, March 14, in Chicago.

Oil will be the fuel used, and the cost will be somewhat cheaper than if coal were burned. Location of the heating plant has been changed from the basement of the office building to the ground level at the east central section of the factory, eliminating excavation work for the heating, and leaving the oil tank the only underground unit of the system.

Mechanics' Lien Act May Be Amended

Elimination of difficulties in receiving payments by contractors, suppliers of materials, and others engaged in construction operations, is expected to result from the adoption by the States of a uniform mechanics' lien act, a revised draft of which has just been completed by a committee in collaboration with the Department of Commerce. Adoption of the act, the committee believes, will tend to improve credit conditions in the building industry, and will provide an equitable balance between the burdens to be assumed and the benefits to be derived by persons affected. Following are the salient features of the revised uniform mechanics' lien act:

When the owner observes procedure that is set out in the act, liens against his property are limited to the contract price. By the terms of the act, liens are effective from the time the building project is commenced. Provision is made for the giving of informal notices by lienors to inform the owner of unpaid accounts, and the making of payments by the owner is regulated.

The act provides penalties for the misapplication of funds intended for construction purposes.

As a preliminary to instituting action to recover a lien debt, a formal claim of lien would be filed for public record within three months after the final performance of services by

the lienor and the form of this notice is set out. Action to enforce the lien may be begun within one year from the filing of this notice.

The priority of liens among themselves and in relation to other forms of encumbrance is designated.

The act also provides for the taking of a bond from the contractor by the owner which would be conditioned for the payment of all lien claims. The method of enforcing claims under such a bond is prescribed.

Original preparation of the act was in the hands of a committee appointed by President Hoover while Secretary of Commerce in 1925, at the request of the National Association of Builders' Exchange, and is representative of all the interests involved. Stewart A. Jellett, Philadelphia, Pa., former president, Heating and Piping Contractors National Association, is serving on the special committee, appointed by the National Conference of Commissioners on Uniform State Laws, cooperating with it. The conference gave its approval to the act at its annual meeting in September, 1931, and this body and the American Bar Association will take their final action on the draft at their annual meetings in 1932.

Copies of the revised draft in printed form may be purchased from the secretary of the committee, Dan H. Wheeler, Bureau of Standards, Washington, D. C. Single copies are available at 10 cents per copy, and a schedule of reduced prices applies on quantity lots in excess of 25 copies.

Loree Is Author of Book on Anthracite

Leonor P. Loree, president of the Delaware & Hudson Railroad, is the author of a new book, "The Story of Anthracite," published by The Hudson Coal Company, of which Mr. Loree is also president.

The book contains nineteen chapetrs and a glossary, and traces the geology, geography, and development of the anthracite industry. Particularly interesting are the chapters devoted to the part played by the mines in developing the canals and railroads of Pennsylvania. Methods of mining, preparation of the fuel for the market, management, and relations of the operators with the miners, are discussed in a non-technical way.

COMING EVENTS

MAY 9-11, 1932. Annual Meeting of the Natural Gas Department, American Gas Association, to be held in Tulsa, Okla. Headquarters at the Mayo Hotel.

MAY 9-11, 1932. National Pipe and Supplies Association Convention, to be held in Pittsburgh, Pa. Headquarters at the William Penn Hotel.

MAY 16-18, 1932. Forty-Third Annual Convention of the Heating and Piping Contractors' National Association, to be held in Detroit, Mich. Headquarters at the Book-Cadillac Hotel.

MAY 18-19, 1932. National Warm Air Heating Association Convention, to be held in Columbus, Ohio. Headquarters at the Deshler-Wallick Hotel.

MAY 23-25, 1932. Annual Convention of the American Boiler Manufacturers Association, to be held in White Sulphur Springs, W. Va. Headquarters at the Greenbrier Hotel.

JUNE 6-10, 1932. Twenty-Fifth Annual Convention and Exposition of the National Association of Building Owners and Managers, to be held in Chicago. Headquarters at the Drake Hotel.

JUNE 14-17, 1932. Annual Convention of the National District Heating Association, to be held in Pittsburgh, Pa. Headquarters at the William Penn Hotel.

JUNE 20-23, 1932. Fiftieth Annual Convention and Exhibit of the National Association of Master Plumbers, at Madison Square Garden, New York.

JUNE 27-29, 1932. Semi-annual Meeting of the American Society of Heating and Ventilating Engineers, to be held in Milwaukee, Wis. Headquarters at the Hotel Pfister.

JUNE 27-JULY 1, 1932. Semi-annual Meeting of the American Society of Mechanical Engineers, to be held in Bigwin, Canada.

New Division of A. G. A. Embodies Gas-Fired House-Heating

A new division of the manufacturers' section, American Gas Association, to be known as the gas-fired boiler and furnace division, has been formed. Automatically included in the membership of the new division are the members of the existing Gas Heating Boiler and Furnace Association, as well as all of the membership who were not before identified with that association, but who were members of the A.G.A. Its membership will embrace those interested in all types of gas-fired house-heating equipment used below the foundation. The new arrangement will put the resources and services of both organizations at the disposal of the members.

J. E. Kinner is the chairman of the new division, E. A. Jones will serve as vice-chairman, and the secretary will be F. W. Herendeen. A meeting of the new division has been called for May 17, a day before the opening of the National Warm Air Heating Association convention, at the Deshler-Wallick Hotel, Columbus, Ohio.

Announcement of another new branch, to be known as the gas-fired steam radiator division, is expected in the near future.

Charles L. Edgar

Charles L. Edgar, 71, president and general manager of the Edison Electric Illuminating Company of Boston since 1900, died April 14, of pneumonia, in Atlantic City, N. J., where he had been resting after a slight illness.

Born in Griggstown, N. J., Mr. Edgar graduated from Rutgers College in 1882, starting his business career as a constructing engineer with the Edison Electric Light Company of New York.

At the twenty-second annual meeting of the National District Heating Association, held in Boston during June, 1931, Mr. Edgar made the opening speech, welcoming the delegates to that city.

Eben MacBurney Byers

E. M. Byers, 51, chairman of A. M. Byers Co., Pittsburgh, Pa., manufacturers of wrought iron pipe, died March 31, in New York, from what was reported to be radium poisoning.

C. H. Dutcher

C. H. Dutcher, for over ten years associated with Kieley & Mueller, Inc., New York, in the capacity of sales engineer and manager, died on March 23, after an illness of several months.

New Equipment

Electrol Richardson Boiler-Burner Unit

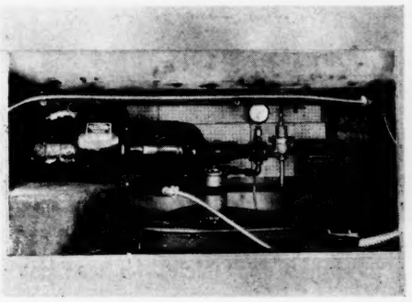
Electrol Incorporated, 170 Dorcas St., St. Louis, Mo., exhibited to the public for the first time at the Boston oil burner show, the Electrol Richardson oil-burning unit, a combination of boiler and burner designed expressly to operate in conjunction. The equipment may be adapted to either steam or hot water heating systems, and is most compact in arrangement.

Richardson & Boynton Co., New York, N. Y., is manufacturing the boiler, which is of the steel fire tube type, mounted horizontally, and similar to the Scotch marine construction. It consists of two shells, the outer being 24½ in. in diameter, and the inner, placed eccentric to the outer, and called the boiler proper, of 20½ in. diameter, and 48 in. in length. The distance between the shells at the bottom is ¾ in., leaving a space of 3¼ in. at the top. A central tube, or combustion chamber, 12 in. in diameter, traverses the inner shell, and this is surrounded by 57 fire tubes of 1½ in. outside diameter. The outer shell forms a preheating jacket and steam space.

Two outlets at the top of the boiler proper provide for the passage of steam into the outer shell, tending to equalize the pressure in both compartments, and allowing the warm feed water to pass into the inner shell through the lower ports. A cast iron drum, having four pipe connections to the feed water shell, is sealed into the smoke box at the rear of the boiler. An indirect heater, with two outlets for domestic hot water supply is located within the drum.

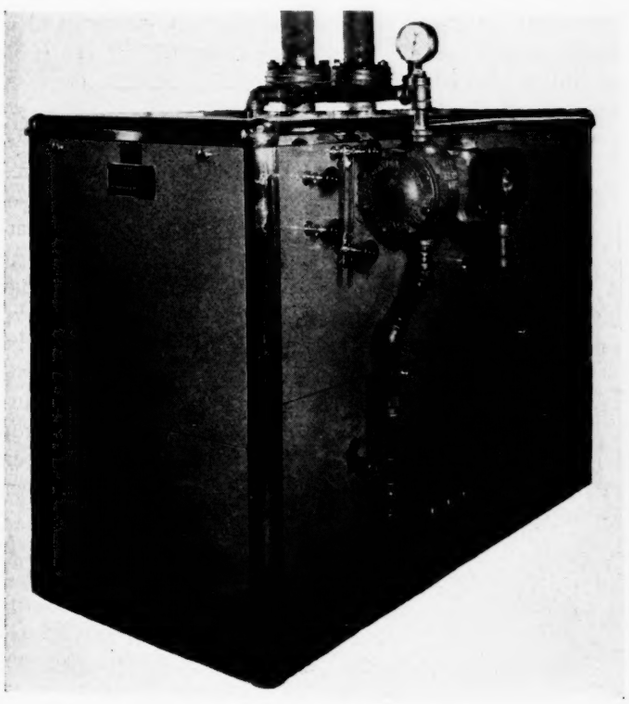
Standard Electrol parts are used in the burner, located beneath the boiler, and arranged for compactness. A pressure atomizing nozzle is used, and the combustion air is given a rotary motion by vanes before it is mixed with the oil spray. Cool air is passed continuously over the nozzle, both during operation and during shut-down periods, to cool the burner. A high-tension constant arc provides for ignition, and regulating valves maintain constant oil pressure.

A fan, located at the back end of the boiler, creates an induced draft, making operation independent of the draft and chimney conditions. As the oil is sprayed into the combustion chamber under pressure, it immediately comes into contact with the rotating air, where combustion takes place. Heat is re-radiated from the refractory lining the combustion chamber, to the combustible mixture, so that combustion is complete by the time the gas enters the flue tubes at the end of the boiler. Products of combustion are then passed to the front of the boiler through the 37 upper tubes, and returned to the rear through the 20 lower tubes, where the fan delivers them to the stack.

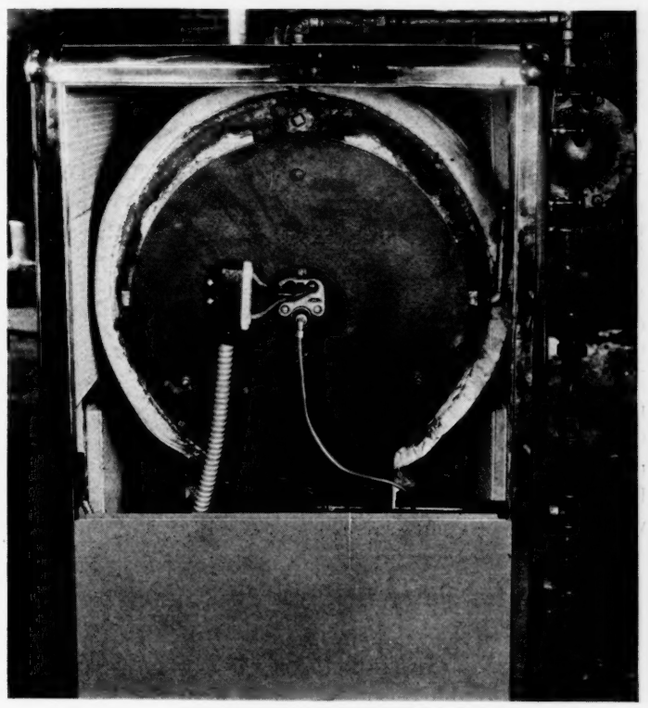


Oil burner seen through side door

A rectangular shell, insulated with acoustical material to reduce mechanical and combustion noises, encloses the unit. The case is blue enamel, with nickel-plated corner rails. Doors in the side permit inspection and adjustment of the mechanical parts of the burner, and a third door in the front of the boiler provides access to the firing head.



Electrol Richardson oil burning unit installation



Front open, showing eccentric shells

New Equipment

Air for combustion is admitted through ports in the side doors, and cools the motor before entering the air register.

Units are manufactured in three sizes, having capacities of approximately 600, 1500, and 4000 sq. ft. of equivalent direct steam radiation. Over-all dimensions of the unit displayed at the Boston show are: height, 28 in.; width, 31 in.; length, 6½ feet.

Johnston Deep Waterleg Boiler

Johnston Brothers, Inc., Ferrysburg, Mich., are manufacturing a low-pressure, welded steel heating boiler in which special attention has been given to the design and construction of waterlegs. These have been widened, to reduce the possibility of steam locking and consequent burning. The boiler is intended for stoker firing, and to this end has a high crown sheet, to provide large combustion space. Capacities range from 4000 sq. ft. to 35,000 sq. ft. of steam radiation.

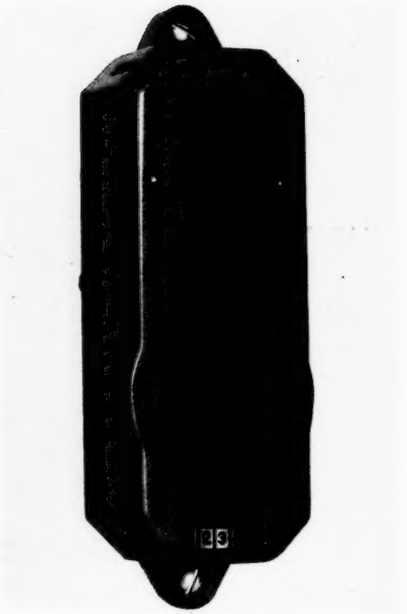
Dulrae Panel Heating

An English concern, the Dulrae Manufacturing Company, has introduced a system of ceiling panel warming, which makes use of heating apparatus applied to the ceiling in the same manner as wallpaper.

It consists of thin sheets of insulating material, through which electric heating elements are run. An automatic control switches the power on and off automatically, to maintain a uniform temperature in the space being warmed. It is claimed that the principal fire offices have approved the device, and that it has been passed by the board of trade and Lloyd's for use aboard ship. The application by means of paste is said to have no harmful effects on the panels, and it is impervious to moisture and oil paint.

Detroit Humidity Control Equipment

Detroit Lubricator Co., Detroit, Mich., is marketing a humidity control, designated the No. 697 Genuine Detroit humidistat. The instrument is designed primarily for residence use, and may be applied either for opening and closing a water supply to the spray pan, or other evaporating device of a humidifier, or for starting and stopping electrically-operated humidifying equipment.



Detroit humidistat

A humidity responsive element, made of seasoned wood, actuates a contact device, equipped with a permanent magnet which closes the circuit as the relative humidity in the vicinity of the instrument is reduced, and breaks it as the moisture is increased. An adjustment wheel at the bottom of the instrument makes possible the selection of any desired degree of relative humidity within a range of from 20% to 50%. The differential of operation will depend upon the air movement and the rapidity of moisture change, but reasonable closeness of control is claimed.

For starting and stopping the flow of water, the humidistat is used in conjunction with the No. 683-W Detroit solenoid valve, which is inserted into the water supply line. The valve has a port opening of 3/32 in., and will operate at a water pressure as high as 125 lb. A low voltage coil opens the valve when the circuit is closed, and the valve closes immediately the circuit is broken. A transformer is used to step the line voltage down to 20 volts.

When used to start and stop electrical appliances, the humidistat is used with a relay-transformer combination, thus making it possible for the low voltage instrument to control a high voltage circuit.

Instrument is 6 in. in height, 1⅞ in. wide, and projects from the wall 1¼ in. In appearance, it closely resembles the conventional wall thermostat.

Solenoid valve

Silent Glow Oil Burner for Apartment Houses

The Silent Glow Oil Burner Corp., Hartford, Conn., is marketing the Model G oil burner, designed primarily for apartment houses and larger homes. The burner is equipped with a ¼ hp. repulsion induction motor and a Sirroco type blower.

Teeple Motorized Gas Valves

L. R. Teeple Co., Portland, Ore., has placed on the market a line of motorized gas valves for gas heating systems.

Two types of valves are manufactured. Type S, the smaller of these, controls the flow of gas only. It is designed for use on water heaters, room heaters, and small furnaces, where auxiliary equipment is unnecessary. It operates on the open circuit principle, and uses no power except during the actual time of opening and closing.

A larger valve, type D, is equipped for the control of conversion burners, large furnaces, and small boilers. A damper arm for primary air doors, and a mercury-tube type switch for control of furnace fans

or other auxiliary equipment are provided. The larger valve operates on a closed circuit, drawing a small amount of current to hold the valve open, with provision for automatically closing it in case of power failure.

Both valves are powered by induction motors which are said to be without radio interference. They operate on low voltage, from a small transformer included in the equipment, and which is connected to the lighting circuit. Connections for control instruments and transformer are made by means of readily accessible terminals, located inside the valve cover. A manual control is provided so that gas may be turned on and off in the event of current failure.

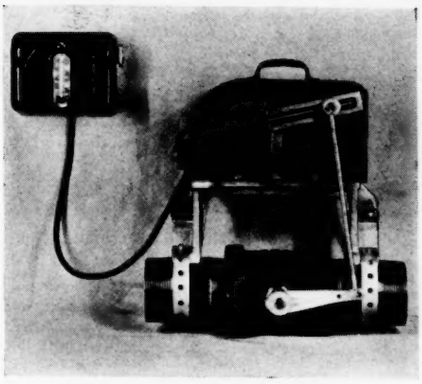
Automatic Temperature Control for Hotbeds

A new device, perfected by the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., that automatically controls the temperature for hotbeds, was exhibited for the first time at the flower show recently held in the Cleveland Auditorium. Use of the apparatus is said to cut in half the normal time required for plants to take root.

Equipment is installed under the hotbed in which the seedlings or sprouts are planted, and by electrically regulating the temperature, the quality of the plants is improved, in addition to decreasing materially the time required for their germination and maturity.

Superstat Temperature Control

A temperature control device is being manufactured by the Superstat Co., 38 Walter St., Springfield, Mass. The control is available in two forms, a damper type regulator, having an operating arm moving in an arc of 90°, and a valve type regulator, which is mounted directly on a globe valve for complete closure, or on a butterfly valve for intermediate control. Both units have eleven operative positions for the actuating member. The lever unit has a lifting capacity of 12 lb. on the arm, and the valve control has ample power to operate valves up to 4 in. on low pressures.



Superstat connected to valve operating unit

A reversible squirrel-cage motor powers the control, and a differential of 1/8° of temperature is said to be sufficient to change its position. The device is particularly adapted for remote control of zone heating systems.

Blackie Surface Heat Flow Gauge

An instrument for the direct measurement of heat dissipated from surfaces has been developed in England by A. Blackie, of the

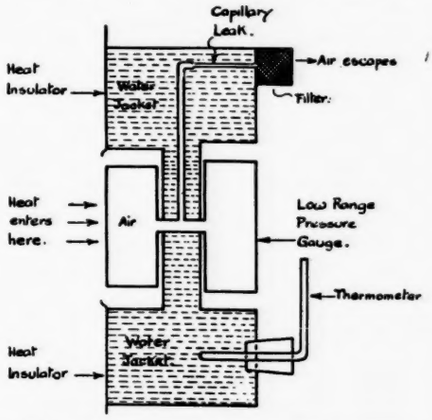
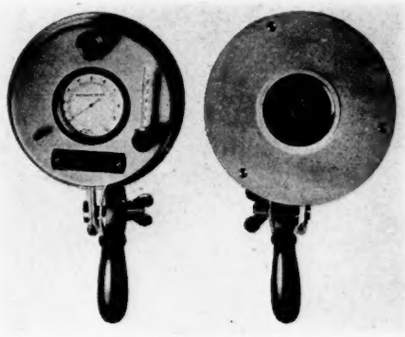


Diagram of surface heat flow gauge

Fuel Research Station, Department of Scientific and Industrial Research, and is being manufactured by Foster Instrument Co., Letchworth,



Front and rear views of gauge

Hertsfordshire, England. It is called the Blackie surface heat flow gauge.

Essential parts of the instrument are an air chamber, connected to a sensitive manometer, and a restricted orifice, in practice a capillary tube, also connected to the chamber. When the chamber is placed in such a position that it receives a flow of heat on the exposed surface, the rate of rise of pressure in the chamber will be proportional to the rate of flow of heat into the chamber. But as the pressure rises, air will escape from the orifice, the flow increasing with rising pressure. As this flow increases, a condition will be reached at which the rate of loss of air due to expansion will exactly compensate for the rate of pressure rise, and a state of equilibrium at a constant pressure will be established. The value of this steady pressure will, for the same instrument, depend upon the rate of flow of heat to the chamber, and it is the measurement of this steady pressure which is taken as the measure, after suitable calibration, of the flow of heat.

An instrument for use on flat surfaces is illustrated. The air chamber consists of a thin aluminum box, mounted inside a recess with polished walls, and surrounded by a water jacket. The front face of the chamber is dull black on both surfaces, and the rest of the chamber is polished. Contact with the surface, whose heat loss is to be measured, is prevented by a raised ring on a non-conducting screen.

A tube connects the chamber to the capillary orifice, both orifice and tube being surrounded by the water jacketing, and a dust filter prevents foreign matter from entering the orifice when air is drawn back into the chamber as the instrument cools after use.

Readings are made by means of a pressure gauge, recessed into the water jacket, which is calibrated in inches of water. A thermometer is provided to determine the temperature of the jacket water.

Flow of heat to the surface of the chamber is partly by radiation, and partly by convection. The radiated heat will not differ from that emitted when free radiation takes place,

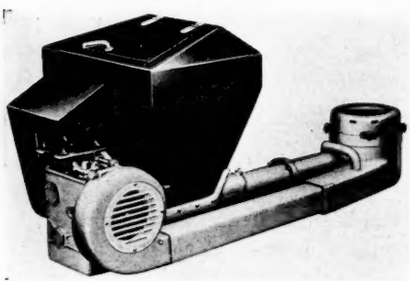
but the convected heat will be somewhat different in this restricted space from what it would be on an open surface. Provided there are no drafts, this source of error is allowed for by the method of calibration.

Calibration of the heat flow gauge consists of comparing the readings of the instrument with the known heat losses from an electrically-heated copper plate, which can be computed from the power input. An additional reading is taken on the wall of a metal box, filled with boiling water, or water at some other known temperature, and the reading marked on the calibration chart. This box is the carrying case for the gauge, and thus provides a check on the constancy of the instrument.

If the instrument is placed sufficiently far from the surface to be tested, the radiation loss alone can be determined with reasonable accuracy, the effect of conduction having been eliminated.

Fire-King Domestic Stoker

A stoker designed expressly for use in domestic furnaces and boilers has been announced by the Fire-King Stoker Co., Indianapolis, Ind. It is designated the Fire-King No. 3, and is intended to burn 1 in. nut and slack screenings.



Domestic stoker

The device operates on the underfeed principle, and multiple feed control is provided, by which the amount of coal fired can be varied from 1 lb. to a maximum of 40 lb. per hr., to meet all conditions of heating demand. Air control is also provided, so that air for combustion can be regulated to comply with the requirements of the fuel. A fan damper automatically closes the air supply while the stoker is not running, and opens it when the air flow starts as the stoker is started.

An air inlet to the feed tube prevents fumes or smoke from the hopper entering the basement, and a fitted cover on the hopper provides for further cleanliness. All moving parts are enclosed.

Operating power is supplied from a ¼ h.p. motor, connected to the gear case by a V-belt drive. Thermostat and stoker switch are included as regular equipment.

Rating is placed at 950 sq. ft. of steam radiation, or equivalent. The stoker may be placed either in front or to the side of the heater, and it is claimed that the apparatus is unusually easy to install.

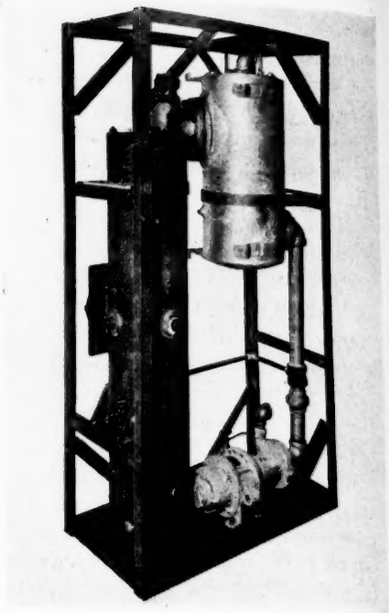
Modulating Adjustment on Eureka Valves

Eureka Valve Division of the Ohio Pattern Works & Foundry Co., Cincinnati, Ohio, has announced improvements on its packless radiator valves, and the addition of a modulating feature for controlling steam flow. A stop, held in place by the packing nut, can be set for any desired valve opening by loosening the nut slightly. A finger on the handwheel engages with the stop, and holds the valve at the pre-determined position.

Carrier-York Air Conditioning Unit for Stores

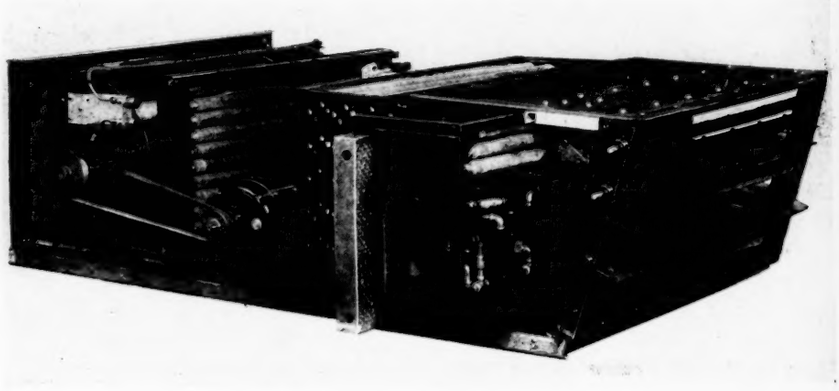
Carrier-York Corp., Philadelphia, Pa., has announced a system for air conditioning small stores. It is designed to provide cooling, dehumidification, cleaning, and circulation of air in summer, and warming and humidification in winter.

A conditioning unit, containing a series of coils and filters, and having a motor-operated blower for circulation, is suspended over the vestibule, under the counter, or in some other convenient and little-used space. Through the coils a refrigerant, generated in a separate apparatus, is pumped.



Steam ejector refrigerator

Where steam is available, a steam ejector refrigerator may be used. A jet of high velocity steam, passed over an opening into a tank in which ordinary tap water is sprayed, produces a vacuum in the tank by drawing out the air and water vapor. The reduction of pressure is sufficient to permit the boiling of the water at a temperature of approximately 40° to 45°. Water vapor evolved in the process is entrained by the steam, and the temperature of the water remaining in the tank is sufficiently reduced by the evaporation, for use as the refrigerant in the conditioning unit.



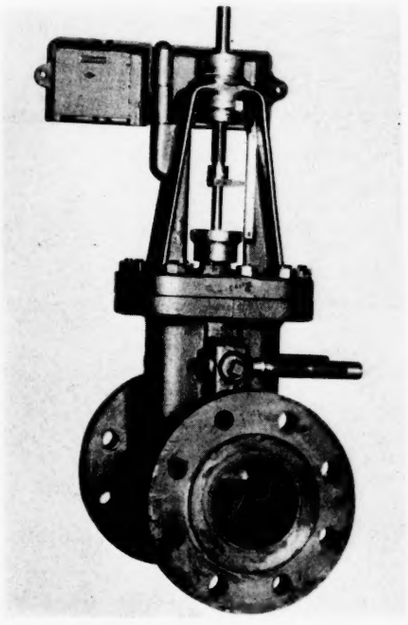
Carrier-York store air conditioning unit

When the steam ejector system cannot be advantageously used, other refrigeration machinery may be substituted.

For winter conditioning, the unit is equipped with heating coils and a humidifying chamber.

Adjustable Orifice for Flow Meters

Bailey Meter Co., Cleveland, Ohio, has developed an adjustable orifice to be inserted into a steam heating, water, or gas line, and used in conjunction with any differential head type of fluid meter. This makes possible the use of the meter over a wide range of capacities, without disconnecting the meter or by-passing the flow. The device is suitable for use with meters for measuring gas or steam at low pressures.



Bailey adjustable orifice

Gate height variations, accurate to 0.001 in., can be made by means of the micrometer screw. Curve sheets furnished with the orifice give the readings corresponding to any desired maximum capacity. Connection to the meter is made at two outlets, tapped into the body of the orifice, at each side of the gate segment.

New Radiator Vacuum Valves

Frederick Wackenhuth, 97 Lafayette St., Newark, N. J., has announced the Ace vacuum valve. The device makes use of a combination of a thermostatically-operated pin valve, and a ball check valve on a conical seat. The ball does not move directly upward, but on an incline, and a very small air pressure will open it. It is claimed that the valve retains the radiator heat for a considerable time because of the vacuum seal when the ball valve is closed.

Salisco Piping Insulation

An insulation for piping and refrigerators has been placed on the market by the Salem Lime & Stone Co., Louisville Trust Building, Louisville, Ky. Known as Salisco, the insulation combines the use of rock wool and aluminum foil sheets, each of which in itself is high in thermal efficiency.

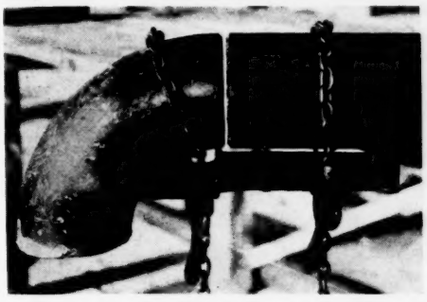
The sheets of foil are suspended between layers of rock wool and do not come in contact with other material for support. The reflective qualities of the foil are maintained inasmuch as the proportion of actual surface contact with the wool is extremely small, and the convection is reduced to a minimum due to the fibrous character of the rock wool.

The heat transmission of the insulation is reported by the firm's laboratory as 0.21 B.t.u. per in. per sq. ft. per degree difference at a mean temperature of 70° F. Weight, approximately ¾ lb. per sq. ft. per in. thickness.

Jewel Welding Tools

The three clamps illustrated are manufactured by the Jewel Mfg. Co., St. Paul, Minn., and are designed to make the steamfitter's work faster and easier by holding the pipe and fittings rigidly in place, and in exact alignment, while the weld is being made.

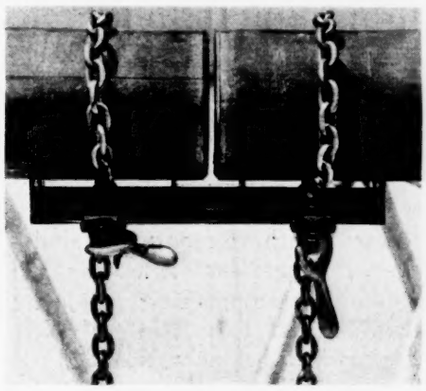
The pipe clamp consists of a beam having four sets of legs, forming four V-shaped notches. The abutting ends of pipe are lined up



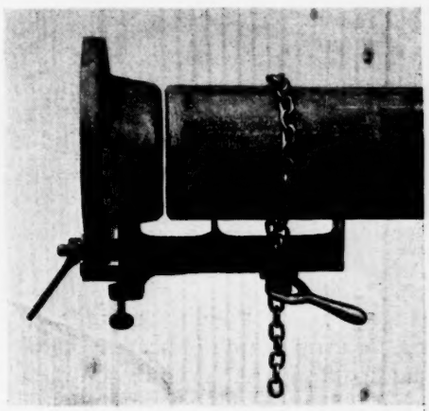
Welding clamp for bend

and held tightly in position by means of two chain clamps. The device will take any size of pipe from ½ in. up to 8 in., and a larger size may be used with 8 in. to 16 in. pipe. The tube turn clamp is of similar construction, the end which receives the tube being shaped to fit that member. It will take a 45° bend as well as a 90°, and may be used with pipe from 2½ in. to 8 in.

Flange faces may be lined up at perfect right angles to the pipe, and rigidly supported for welding, by the use of the flange welding clamp. This device is fixed to the pipe by the chain clamp at one end, and clamps to the flange at the other by means of a screw. A thumb screw adjusts the flange up and down for centering. It is supplied in two sizes, the smaller for pipe sizes from 2½ in. to 8 in., and the larger for 8 to 16 in. pipe.



Clamp for welding straight runs



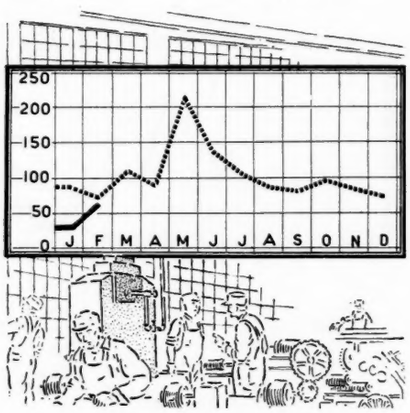
Flange welding clamp

Business Statistics

(Dotted line in charts, 1931; solid line, 1932)

Six of the twelve series charted from data supplied by the Department of Commerce are included this month in the graphs on these pages. Of the other six, steel boilers, cast iron boilers and radiators have not reported. Oil burners show a gain of almost 10% over the same month in 1931. Stokers dropped about 15% from the same month last year.

R. G. Dun & Company reports an average bad debt loss of 0.678% for manufacturers of heating, ventilating, and air conditioning equipment.

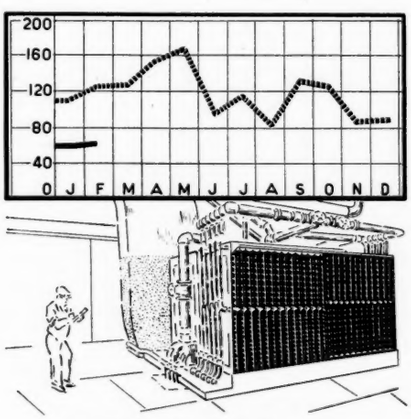


Air Conditioning Units and Washers
Orders in Dollars
February, 1932, 67,300; February, 1931, 73,-200; decrease over last year, 8%.

This was based on the reports of 26 concerns selling 9624 accounts whose sales totaled over $3 million in the first six months of 1931. The loss ranged from a high of 1.075% for merchandise sold to jobbers, to a low of 0.420% on goods sold to other manufacturers. According to territory, a high of 1.513% was noted for Ohio, West Virginia, Kentucky, Illinois, Indiana, Missouri and Kansas, and a low of 0.481% for the southwestern states.

Reports on building permits issued during March indicate, according to *Bradstreet's,* that contracts awarded in the near future will be still smaller, which means that further curtailment must take place in building and allied industries. According to the same authority, real estate transactions are almost at a standstill. In the month of February, according to the Department of Commerce, long-term real estate bond issues declined to nothing. None was issued on mortgages, nor for new construction or acquisition and improvement purposes.

According to a recent survey by the Dow-Jones Service, 40% of the building operations at the present time are largely speculative; about 50% of the communities in the Eastern states are overbuilt; and the amount of mortgage money is far too low to take care of the building needs in the regions that are not overbuilt.

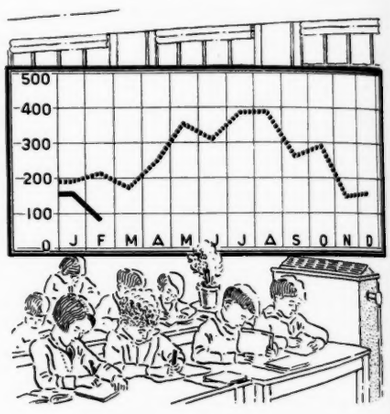


Indirect Heating Surface
Orders in Dollars
February, 1932, 61,178; February, 1931, 124,-368; decrease over last year, 51%.

For the month of March, the Federal Reserve Bank reports only 45 bank suspensions, as compared with 342 in January, and 122 in February.

Last month we reported a tabulation of profits for 15 heating and plumbing manufacturers, made by the National City Bank of New York, which has now expanded the list to 22 firms. These concerns showed annual net profits, totaled, of $53 million for 1929, $20 million for 1930, and a deficit of $9 million for 1931. This compares with profits of over $3 billion for 1929, $2 billion for 1930, and less than $1 million for 1931, for 1302 manufacturing concerns covering all industry.

The U. S. Department of Labor indexes of wholesale commodity prices indicate considerable change in the relative costs of plumbing and heating materials, as compared with all building materials and with commodity prices in general. On the basis that 1926 = 100, the index of plumbing and heating was 79.9 for December, while that for all building materials was 75.7, and for all commodities 68.6. In January, however, the index for plumbing and heating had dropped to 74.1, below that for building materials, which was 74.8. The index for all commodities had declined to 67.3 in January.



Schoolroom Unit Heaters
Orders in Dollars
February, 1932, 84,523; February, 1931, 217,-387; decrease over last year, 61%.

For February the index for heating and plumbing dropped sharply to 65.8, whereas the index for all building materials dropped only from 74.8 to 73.4.

The Building Construction Employers' Association has listed comparative prices of various building materials for 1929 and 1932. The

list shows such declines as: finished steel structural shapes, $2.05 to $1.70; first grade white oak flooring, $100 to $92; common brick, $12 to $9; cement in cloth, $2.25 to $1.75.

Comparing February, 1932, with the same month, 1931, the United States Department of Labor reports marked reductions in average prices of plumbing and heating materials, as follows: heating boilers, $108 to $90; lavatories, $10.67 to $8.99; radiation, $0.32 to $0.19; bath tubs, $29.41 to $23.51.

The Division of Statistics and Information, New York State Department of Labor, reports a decline in employment in the building construction industry in the state for January, as compared with the preceding month. The decline amounted to 21% in employment, 19% in total payrolls, and 20% in man-hours. Heating and ventilating work is included in the classification *sub-contracting,* which showed a decline of 2% in employment, an increase of 2% in payrolls, and an increase of 3% in man-hours.

The Bureau of Mines states that production of bituminous coal for the calendar year to April 16 has averaged 1,089,000 tons per day, as compared with 1,315,000 tons per day in 1931.

March building contracts showed an increase of 26%, as compared with February, according to F. W. Dodge Corporation. However, the March figures were only about 30% of those for the same month in 1931.

Of the $112 million reported for the month, 29.5% was for residential buildings, 43.7% for non-residential, and the remainder for public works and utilities.

Reconstruction Finance Corporation is reported to have granted the State Title and Mortgage Company, New York, a loan of over $4 million, a move which has kindled hope in the building industry that the aid thus rendered to mortgage holders may ease the financing situation and result in an increase in building construction.

Federal and state government building construction for February totaled $9.8 million, closely approaching the $11.7 million (in permits) for new residential building. Non-residential building permits for February totaled $19 million.

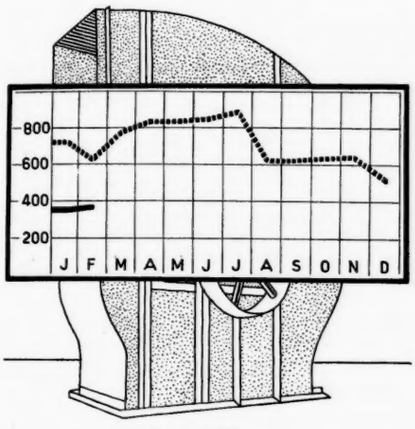
Permits issued during February, in index numbers (1929 monthly average equals 100), as compared with the same month in previous years, show:

	Feb. 1932	Feb. 1931	Feb. 1930
New residential buildings	9.1	30.3	34.7
New non-residential buildings	16.5	43.8	51.8
Additions, alterations and repairs	26.7	48.6	57.5

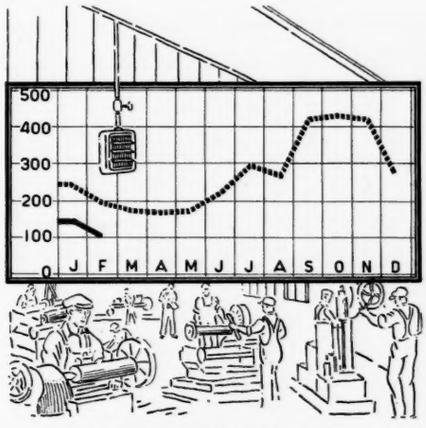
In a series of articles appearing in *The Architectural Record,* L. Seth Schnitman arrives at some interesting conclusions regarding building trends as indicated by the census. He predicts that population growth will have a smaller influence on new residential building in the future; he shows that the one- or two-family house has become definitely the residential type of the smaller cities and towns and predicts that future residential building will result almost entirely from study of the problems inherent in obsolescence.

Mr. Schnitman expects a loss in graded-school building construction, due to the declining birth rate, and forecasts gains in high schools. He believes that as long as present population tendencies continue, demands for more institutions such as hospitals, asylums and homes for the aged will follow the present course. This he lays to the tendency toward a greater percentage of the population consisting of older people.

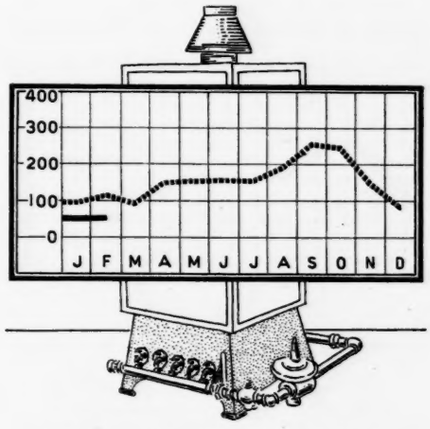
Further, he believes that church structures will tend more and more to be revenue-producing by virtue of containing office and other such rentable space.



Fans and Blowers
Orders in Dollars
February, 1932, 388,488; February, 1931, 629,458; decrease over last year, 38%.



Industrial Unit Heaters
Orders in Dollars
February, 1932, 100,351; February, 1931, 195,243; decrease over last year, 49%.



Shipments of Gas-Fired Boilers
In Thousands of B.t.u. Capacity
February, 1932, 57,713; February, 1931, 114,593; decrease over last year, 50%.

With the Manufacturers

Anthracite Institute Approved List Totals 39

Bulletin 10, issued by the Anthracite Institute Laboratory, Primos, Pa., describes 39 pieces of equipment and auxiliaries, designed for the burning of anthracite, that have been approved by the institute. Each piece of apparatus has undergone severe tests, covering long periods. Among the equipment listed are: seven automatic stokers, nine thermostatic controls, three magazine feed boilers, six service water heating systems, four vacuum furnace cleaners, six blower systems, and four space heaters. Manufacturers of approved equipment are entitled to place the institute's seal on their products.

Detroit Edison Studies Comfort Cooling

The Detroit Edison Co., Detroit, Mich., is investigating the subject of comfort cooling, according to Sterling S. Sanford, sales engineer of that company.

In order to give a practical demonstration of comfort cooling, the company is installing cooling equipment in five of its commercial offices this year. Three of these offices will be cooled with ice; one office by a CO_2 compressor installation, and one office by eight direct expansion cooling cabinets served by three compressors.

The company does not plan to market equipment, but is stimulating interest in comfort cooling and informing customers about the various methods of cooling.

An eight-room house has been selected and the company will install ice equipment to cool it for public show purposes.

Carrier Demonstrates Air Conditioning for Stores

On March 23, the Carrier Engineering Corporation gave a demonstration of air conditioning equipment for small stores at its research laboratories at Newark, N. J. The exhibition was presented in a model store, 55 ft. x 20 ft. x 13 ft., which had been erected for the purpose of testing the apparatus.

Surrounding the model store was a shed in which weather duplicating the hottest and most sultry day of summer could be artificially reproduced. At the time of the demonstration, a temperature of 96° F. was maintained in the shed, and the temperature recorded within the store was 72°. The equipment used for cooling was a Carrier comfort conditioning unit, operating on the steam ejector system.

A unique feature demonstrated in the test was a device for preventing loss of cooling and dehumidifying effect when the store door was opened. This consisted of an outlet across the top of the door opening through which recirculated air from the room was discharged at high velocity, thus forming a screen preventing the entrance of the warm humid air from outside.

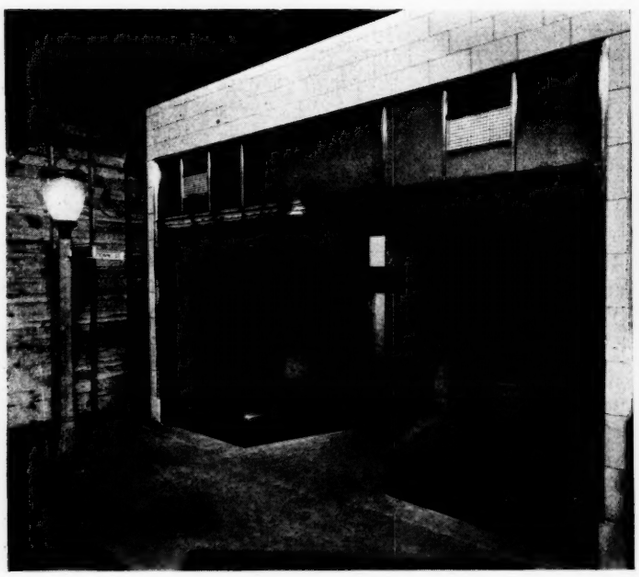
Tables for Engineers Sent on Request

A pocket-sized card, 2¾ in. x 6 in., containing on one side a table of decimal equivalents of an inch, and on the other a table for converting inches to decimals of a foot, has been prepared by HEATING AND VENTILATING, and will be sent free to any reader of the magazine who will send in his request to the Editorial Department, HEATING AND VENTILATING, 148 Lafayette St., New York.

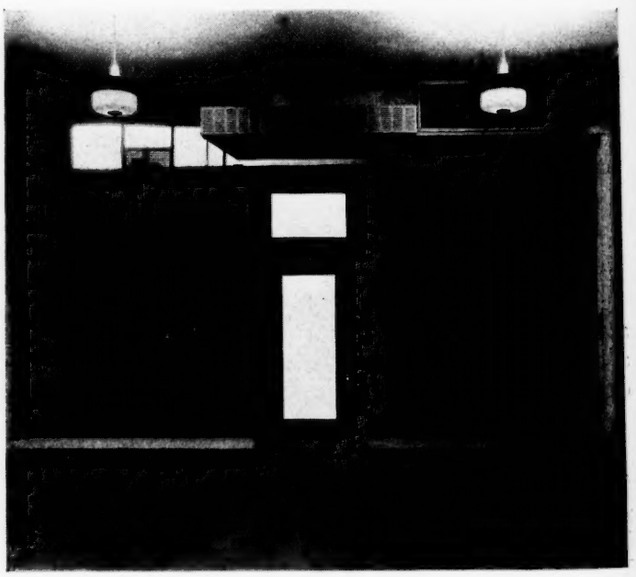
This card will prove useful to engineers, draftsmen, estimators and contractors who have occasion to make slide rule calculations using feet and inches.

Combustion Engineering Gets Government Contract

The contract for erection of a central heating plant for the new Federal building development in Washington, D. C., was awarded March 30 to Combustion Engineer-



Interior of shed, showing store front



Interior of Carrier model store

POWERS Control

for Air Conditioning Equipment *is used by the*

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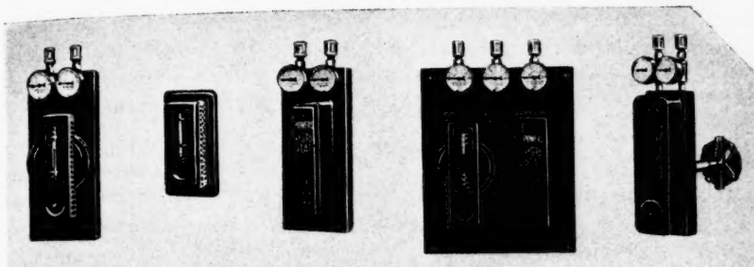
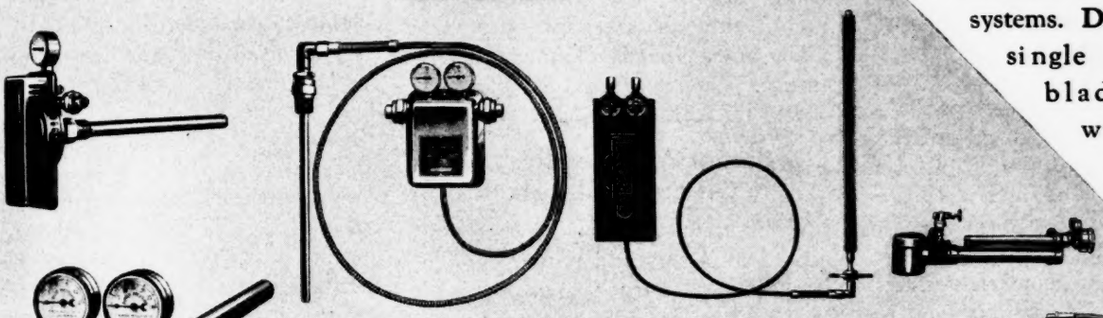
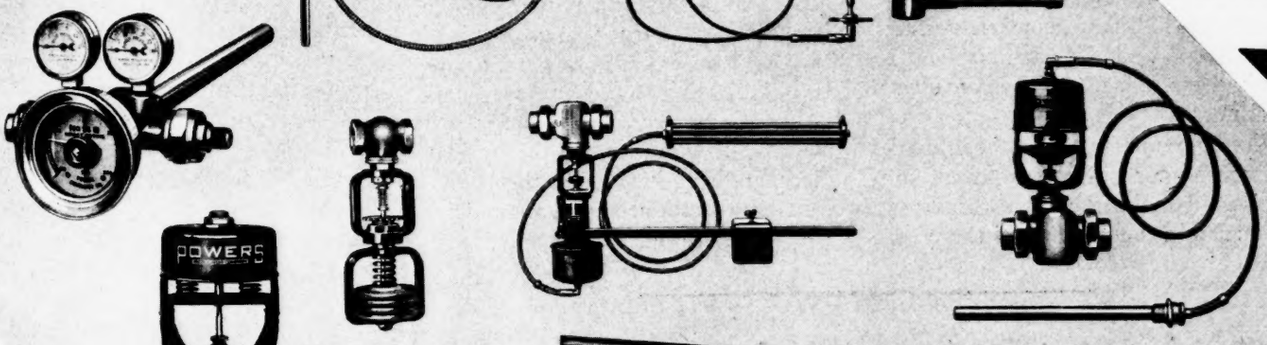
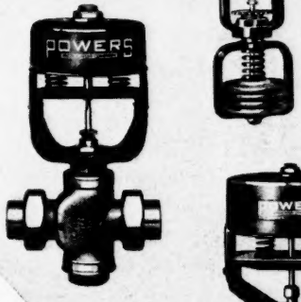
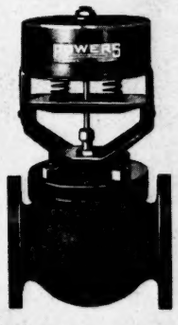


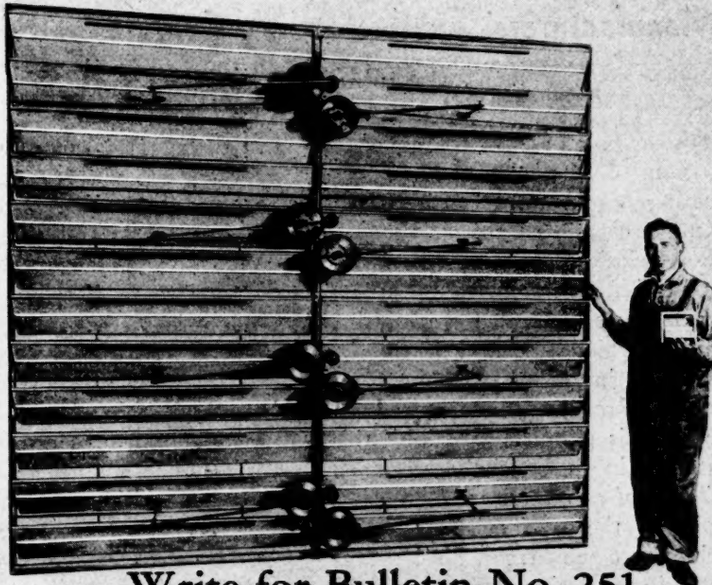




Thermostats—both graduated and positive acting for dry bulb control. **Hygrostats**—both pneumatic and electric for humidity control. **Self Contained Regulators**—complete line for control of air and liquid temperatures. **Regulators**—for control of brine circulating systems. **Dampers**—both single and multiple blade, with or without operating diaphragm motors.







Diaphragm Valves — All metal construction, including three-way valves, brine control valves, etc., etc. **Accessories**—Automatic Water Pan for wet bulb control, Relays, Pressure Reducing Valves, Pneumatic Switches, Dial Thermometers, etc., etc.

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Write for Bulletin No. 251

which describes Instruments for Air Conditioning Equipment

POWERS

With the Manufacturers

ing Corp., New York, N. Y., subsidiary of International Combustion Engineering Corporation. Four 2500 hp. Walsh-Weidner sectional header boilers, and four C-E multiple retort stokers, of the super-station type, are included in the equipment. The contract also provides for steel encased boiler settings, water-cooled furnaces, and forced and induced draft fans and drives.

Boilers are designed for 400 lb. pressure, and are guaranteed for a production of 215,000 lb. of steam per hr. continuous service, and 237,000 lb. maximum, from and at 212° F. The stokers will be 15 retorts wide, 45 tuyeres long, and will have a projected grate area of 480 sq. ft. each. They will be equipped with double roll clinker grinders. United Engineers and Constructors, Inc., Philadelphia, Pa., are the consulting engineers.

No announcement has been made of the amount of the contract, but it is said to be the largest contract awarded in the boiler field this year.

Gas Research Laboratory Moved to Buffalo

The American Gas Products Corporation on April 11 moved its gas research laboratory from New Rochelle to Buffalo, N. Y., where it will occupy the building formerly used by the Institute of Thermal Research, conducted by the American Radiator Company, and now located in Yonkers, N. Y. Carl Flink will continue to direct the work from New York. A staff of approximately 10 men is engaged in testing and developing gas boilers, water heaters, and similar equipment, and an extensive program along these lines is planned for the future.

Kelvinator Acquires Rightway Oil Burner Assets

Kelvinator Corporation has acquired all assets and patents of the Rightway oil burner, manufactured by the Maise Corporation of Detroit, according to the *Chicago Journal of Commerce*. Kelvinator will continue to manufacture the burner, merchandising it through the Rightway organization, supplemented by Kelvinator branches.

Manufacturers' Exhibit at "A Century of Progress"

By FRED G. AUSTIN

IT is the plan of the manufacturers' division of the National District Heating Association to bring to the manufacturers who are members of the association, and other manufacturers who are interested in district steam heating, a plan for exhibiting material which is used in the district steam heating industry, at "A Century of Progress" in Chicago, in 1933. It is planned to exhibit this material in a specially designed building of attractive modern style, depicting the modernistic type of architecture which can be consummated in the design of a power plant for district steam heating.

For many months studies have been in progress and the final plan which has been submitted to the manufacturers is the result. These studies have been for the purpose of determining the possibilities, advantages, and type of exhibit which would be most worthwhile, commensurate to the manufacturer, and at the same time be in keeping with the scientific trend established by "A Century of Progress," which is to portray to the layman how a product is made and used, and its effect upon our social existence.

"A Century of Progress" will open June 1, 1933, and will close about November 1, 1933. Remarkable progress has already been made on financing and building this great exposition. The officials report that they are well ahead of their schedule and that the exposition will be the most truly educational world's fair that has ever been held. The location of "The Century of Progress" is ideal in many respects. It has every requirement desirable in a world's fair—natural beauty, a combination of land and water, proximity to the heart of a large city, and easy accessibility to all visitors.

It is expected that the attendance will be well over 100,000,000 people. To the manufacturers whose sale of merchandise is confined to the steam industry, the advantages of exhibiting to this large potential audience in this specialized exhibit building is apparent. No other space is available which will so favorably present the district steam manufacturers' story.

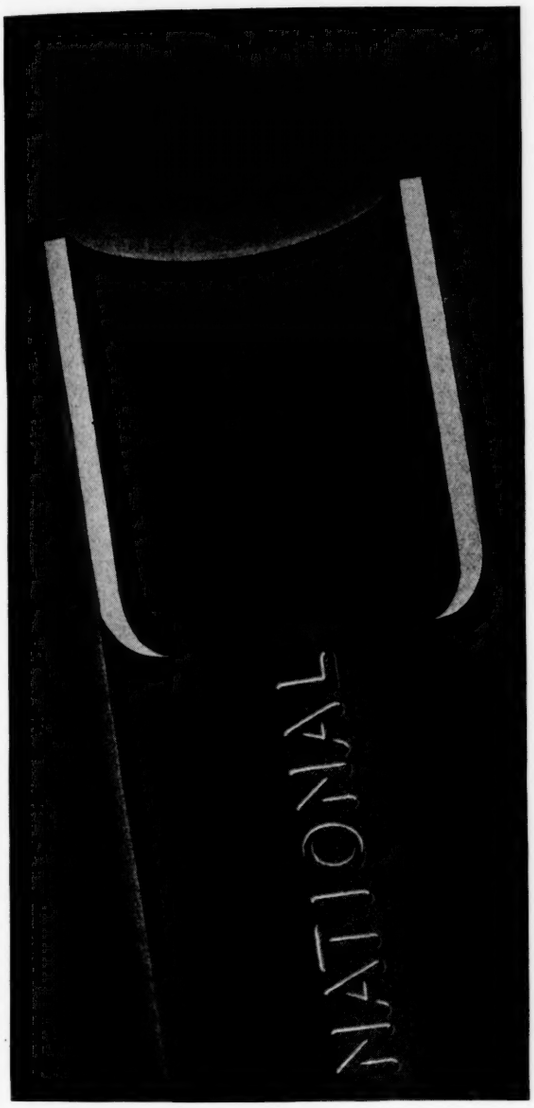
It is proposed that a special company be organized for the purpose of exhibiting the products and the progress of district steam heating and the benefits to be obtained by customers through the use of district steam service. This company is to be operated without profit and the necessary money is to be subscribed as required by the various exhibitors in proportion to the amount of exhibit space. This offers to the small manufacturers an opportunity to combine themselves with the larger manufacturers in a way which will be mutually profitable.

It is planned to maintain at the exhibit a secretary who will be competent to discuss with visitors the various equipment on display. Names of prospects and inquiries requiring specialized information will be turned over to the manufacturer or his district representative. In this manner it will not be necessary for the various manufacturers continuously to maintain individual representatives at the exhibit, but rather they can arrange to have representatives present for special days, such as the period of the National District Heating Association convention.

The result of this study has influenced the manufacturers to prepare for nothing but a purely educational exhibit. It was first thought that steam could be generated and sold to the agricultural exhibit but this plan has been definitely abandoned.

It is planned that the building housing the exhibit for the steam heating industry will be so designed that it will be accessible from all angles. It will be advantageously located in the housing group section. This section will attract most of the people attending "A Century of Progress" due to its proximity to the amusement section. Within the building it is planned to install a

There's ECONOMY, *too, in using* SCALE FREE PIPE !



Economy, and not mere good looks commends the scale free process by which NATIONAL Pipe (butt-weld sizes ½ to 3-inch) is made clean and smooth—free from scale. The impression of uniformity and integrity that you receive in looking at this finely finished pipe is borne out in the character of its structure and by experience in service.

Pipe thus freed from mill-scale is less subject to corrosion, especially pitting. It will retain galvanizing or other protective coats more firmly. It will convey a larger flow of liquid or gas; and it reduces clogging of valves and small openings because there is no foreign substance to come loose and cause obstruction. Moreover, the processes that make it clean and scale free, heighten the strength at the welds, which may be important if bending, coiling or other special manipulation has to be done.

The manufacturers take pride in the fine appearance of this pipe but they take much greater pride in the durability and economy which this appearance truly denotes and which has made NATIONAL—

America's Standard Wrought Pipe

NATIONAL TUBE COMPANY, Pittsburgh, Pa.

Subsidiary of United States Steel Corporation

NATIONAL SCALE FREE PIPE

SPELLERIZED

With the Manufacturers

boiler of 300 hp. showing all the necessary prime movers. A balcony will be built around the boiler for use as an operating floor and from which may be exhibited the materials involved in the heating industry together with a demonstration of their application. It is planned to operate this boiler under artificial means in order that it may appear to be in actual operation.

The first floor of the building, which will be the space visited by the majority of people, will be arranged to attract the layman, with statistics, maps, and data showing where district steam heating is used and the benefits derived therefrom. It has been planned to build two dioramas depicting a modern city with district heating applied and the benefits that are obtained from district heating. Another will show a city without the advantages of district steam. The history of the heating industry will be told in such a way that it will appeal to the layman, and in this way it is hoped that he will become more interested in the subject and more conversant with its application.

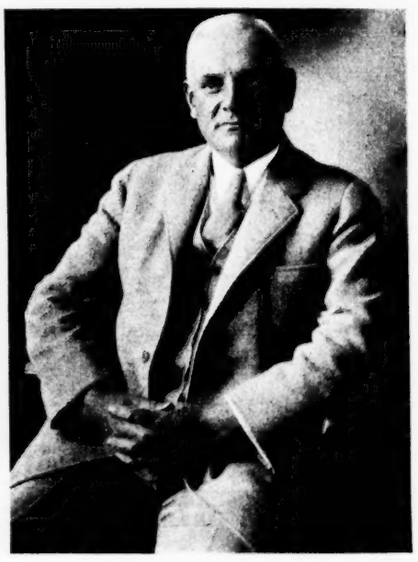
It is the opinion of the leaders of the steam heating industry that this exhibit is a worthwhile undertaking and should be encouraged by the manufacturers. This is the only way it will be possible for the industry to be represented. Every utility and every phase of industrial and social life is represented in a distinct group. It remains for the heating industry to group itself in its own building.

"A Century of Progress" offers to the world the greatest six months' course in practical education that has ever been assembled in one group. There is no branch of our existence that is being omitted. Many of the exhibits are highly technical and show the greatest scientific development possible. The appeal to the younger generation alone will be felt in the industry for years to come. It is left for the heating industry to so influence the minds of the people visiting this educational exhibit that its effect will be far reaching, influencing developments in new fields. There is no advertising that will reach as many people and in such an impressive manner as this method. The budget of the manufacturers for the year 1933 should be arranged with this plan in mind.

The Silent Glow Oil Burner Corp., Hartford Conn., has bought the entire assets of the Mid-West Oil Burner Mfg. Co., Chicago, and will move the latter company's equipment to the Hartford plant. The Mid-West company was in business for four years and manufactured burners for industrial work.

The Conditioned Air Corp., Ford Building, Detroit, Mich., has been organized to build and install air conditioning equipment in residences and other buildings. A central system, the Airco, has been designed to humidify, cool, wash and heat air for residential application. Officers of the company are: President, G. L. Schuyler; vice-president and treasurer, Joseph Sherer, Jr.; secretary, F. S. Ford. Sales representatives have been appointed in New York and Cleveland, and plans are under way to extend the distribution to other cities.

Crane Co., Chicago, Ill., announces the appointment of W. K. Glen, formerly advertising manager, as divisional manager in charge of the Chicago district, with offices at 156 North Jefferson St., Chicago. Mr. Glen will direct sales development and merchandising plans.



W. K. Glen

B. F. Sturtevant Co., Hyde Park, Boston, Mass., has elected E. B. Freeman president to succeed former Gov. Eugene N. Foss, who was elected chairman of the board. Mr. Freeman, for many years, was vice-president and general manager.

Copeland Products, Inc., Mt. Clemens, Mich., announces the appointment of Geo. A. Clark & Son, Inc., Minneapolis, Minn., as its distributor for Minnesota, Wisconsin, and the Northwest territory formerly represented by the Geo. C. Beckwith Company. The latter company was merged with Geo. A. Clark & Son last fall.

Maryland Air Conditioning Corporation, Baltimore, Md., has issued a catalog illustrating and presenting the general specifications of a number of installations made by the company. The company announces that it has purchased the physical assets and patents of the Bentz Engineering Corporation, Newark, N. J.

The Frost Research Laboratory, Inc., Norristown, Pa., has issued a booklet, called the *Test Log*, in which the research facilities and activities of the laboratory are described and illustrated. The laboratory is devoted to investigations in the heating, ventilating, and air conditioning field.

The ChilAire Corp., Kansas City, Mo., has been incorporated to acquire rights, designs, patents, etc., of ChilAire, a portable cooler developed by the Western Tool and Equipment Co., Kansas City. The latter company is a research organization created for the purpose of carrying along research development work for the City Ice Co., Kansas City.

The McAlear Mfg. Co., Chicago, Ill., recently appointed R. F. Campbell, 1160 National Press Building, Washington, D. C., as its representative in Maryland, Virginia, and the District of Columbia.

Pittsburgh Equitable Meter Co., Pittsburgh, Pa., announces the purchase of the Merco Nordstrom Valve Co., Oakland, Calif. The Pittsburgh concern will continue to manufacture the entire Merco line at the Oakland plant, enlarging it to twice its present size in order to add its own products to the line.

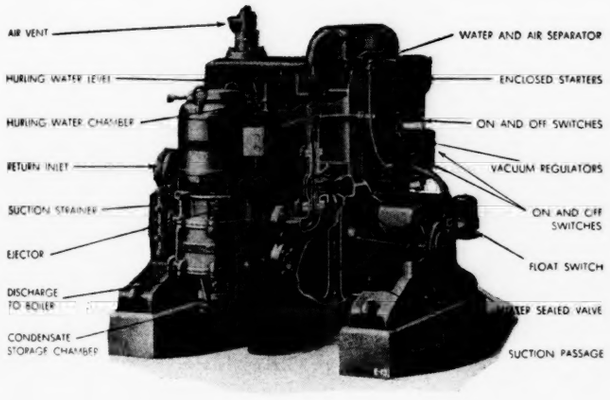
THE INSIDE STORY

THE unit is primed through priming water inlet on top of receiver to an overflow level observed by opening the water level gauge cock.

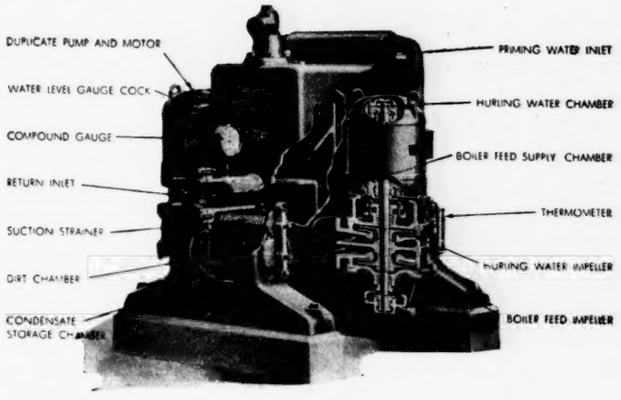
The automatically controlled motor, actuated either by vacuum regulator or float switch, sets rotating element of pump in motion.

Water from the hurling water chamber enters hurling water impeller through a connecting port. The rotation of the impeller sets up a high velocity water jet, which passes through the ejector gap, thereby creating a vacuum in the heating system return main.

Vapor and condensate enter the suction strainer and pass into the condensate storage chamber, and then through the suction passage and water sealed valve. The mixture is compressed in the ejector throat, and finally discharged to the water and air separator.



Ames Type "E" Vacuum Heating Pump



Ames Type "E" Vacuum Heating Pump

Here the air is separated and vented to the atmosphere, while condensate flows over baffle into the boiler feed supply chamber.

Then condensate flows through port opening in chamber connecting with the boiler feed impeller, and is discharged through discharge check valve (not supplied by Ames Pump Company) into boiler feed line.

ON and OFF switch disengages vacuum regulator, while lever on automatic starter, when placed in "HAND" position, throws out float switch and thereby allows continuous operation of the unit.

Vacuum breaker is furnished with continuous operating unit only. It can be set for predetermined maximum vacuum desired on the system. A compound gauge indicates the vacuum, and a thermometer serves as a valuable aid to ascertain condensate temperature.

Bulletin 600

AMES PUMP COMPANY, INC.
30 Church Street **New York, N. Y.**
DIVISION OF AMERICAN LOCOMOTIVE COMPANY
Representatives in All Principal Cities
Manufactured and Sold in Canada by Montreal Locomotive Works, Ltd.

With the Manufacturers

Frank B. Wolfe will act as assistant general manager of the Oakland plant, answerable directly to W. F. Rockwell, president of the Pittsburgh firm.

Governale Bros., Brooklyn, N. Y., manufacturers of radiator enclosures, have taken over the manufacture and sales of the International Radiator Co., Port Chester, N. Y.

The Reliance Electric & Engineering Co., Cleveland, Ohio, has established a sales branch in Grand Rapids, Mich., to cover northeastern Michigan. Marshall T. Ball will be in charge, with offices at 208 Fuller Ave., S.E.

Kisco Boiler & Engineering Co., St. Louis, Mo., has purchased the physical assets, trade names and good will of the Monarch Sales & Engineering Company, and will continue to sell the Monarch return-to-boiler system and repair parts on all Monarch products.

The Stibloy Products Co., Inc., Koppers Building, Pittsburgh, Pa., has been formed to take over the assets of Liquid Metal Products, Inc., Chicago, producers and distributors of Stibloy, a metal compound in liquid form which acts as a primary coating to hold paint, enamel and lacquer tenaciously, permitting immediate finishing of new galvanized metal surfaces. Officers of the new company, control of which has been acquired by the Koppers Products Company, are: President, J. N. Forker; vice-president, S. H. Bell; secretary, John D. Shaner; treasurer, S. T. Brown.

Airtherm Manufacturing Co., 1474 South Vandeventer Ave., St. Louis, Mo., announces the acquisition of the St. Louis assets and business of the Skinner Bros. Mfg. Co., Inc., St. Louis. The Airtherm Mfg. Company will service and furnish parts for Skinner products, and will continue the development work in its lines. Officers of Airtherm are: President, A. W. D. Weis; vice-president, R. J. Tenkonohy; secretary, G. H. Everett. Directors of the company are: Henry B. Weis and Fred A. C. Skinner, together with the above-named officers.

E. B. Maynard

Petroleum Heat and Power Co., Stamford, Conn., announces that E. B. Maynard has joined its industrial equipment department. Mr. Maynard, who previously was connected with the Fuel Oil Engineering Company, also served as a member of the board of governors of the Greater New York Oil Heating Association. He was also associated with the S. T. Johnson Company and the Purdy-Maynard Corporation.

Tube-Turns, Inc., Louisville, Ky., has appointed D. H. Skeen & Co., engineers, 1 North La Salle St., Chicago, Ill., its distributors for that territory. In addition to Tube-Turns, D. H. Skeen & Company also will handle related items, such as Weldolets and Thredolets, manufactured by the Bonney Forge & Tool Works, Allentown, Pa., welding neck flanges, reducers and bull plugs for pipe welding, etc.

B. F. Sturtevant Co., Hyde Park, Boston, Mass., has purchased the Cooling and Air Conditioning Corp., New York, N. Y., which it formerly owned in part.

Carrier Corporation and its subsidiaries are moving their New York offices to the Chrysler Building, New York.

Financial News

Modine Manufacturing Company recently reduced its annual dividend to a 60-cent annual basis from the previous $1 rate by declaration of quarterly dividend of 15 cents payable May 1. Reductions of 25 cents were made in each of the two preceding quarters, lowering rate from the former 75-cent level.

Wolverine Tube Company reports its net income for the year ending December 31, $156,833, equivalent, after preferred dividends, to $1.10 a share on 115,953 no par common shares, contrasted with net loss of $3,670 in 1930.

Universal Pipe and Radiator Company and subsidiaries report a net loss for the year ending December 31 amounting to $498,520, compared with a net loss of $214,550 in 1930.

A. M. Byers Company and subsidiary report a net loss of $131,184 for the quarter ending December 31, compared with a net income of $53,978, or 95 cents a share on 56,744 shares of 7% preferred stock, in the corresponding quarter of 1931.

The United States Radiator Corporation reports a net loss of $1,289,482 for the year ending January 31, 1932, against a net loss of $641,973 in the preceding year.

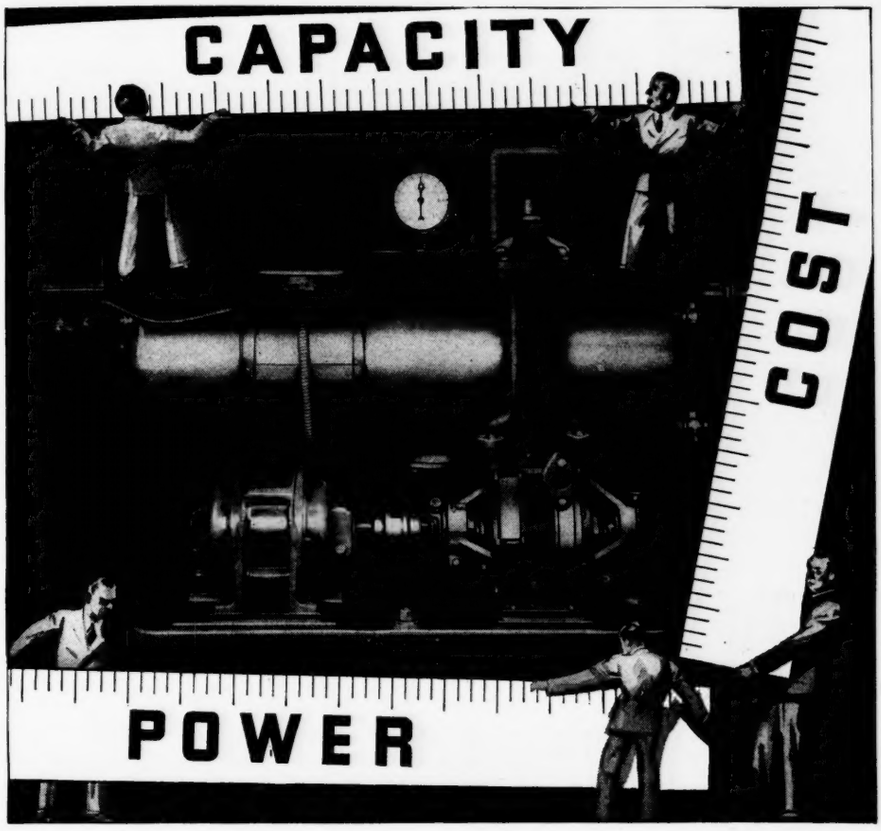
American Radiator & Standard Sanitary Corporation reports a net profit for 1931 of $200,646, as compared with a net profit of $6,641,797 in 1930. Net sales amounted to $87,324,770 in 1931, as compared with $119,299,597 in 1930.

Spencer Heater Co., Williamsport, Pa., reports an increase of 21% in the sale of its boilers during the first quarter of the fiscal year ending March 1, compared with the first quarter of 1931.

Holland Furnace Company reports a net loss of $152,421 for 1931, after all net charges and depreciation, in comparison with a net profit of $1,655,129 for 1930. The company reports an improvement in January of this year.

Johns-Manville Corporation and subsidiaries report a net loss, for the quarter ended March 31, of $912,607, against a net profit of $230,109, equal after preferred dividends to 13 cents a share on 750,000 common shares in first quarter of 1931.

Globe Automatic Sprinkler Company of the United States reports a net loss of $87,748 for the year ending December 31, compared with a profit of $7643 in 1930.



EVERY YARDSTICK OF *Heating Pump Value*

proves there's more for your money in a Jennings Pump . . .

Capacity... power consumption... cost . . . no matter which yardstick you use, the answer is the same. There's greater value in Jennings Vacuum Heating Pumps.

No other heating pump can approach the capacity of the Jennings Pump. For each dollar invested in a Jennings you purchase the removal, in a given time, of more air and more condensation from the heating system with the least power.

Furthermore, tests conducted under actual working conditions on a number of heating systems, prove it costs less to operate a Jennings Pump, both for power consumption and maintenance. We will gladly cite, on request, the results of such tests, or name instances where Jennings Pumps have served 10 and 15 years without repairs or replacements of parts.

Pump ratings in sq. ft. of equivalent direct radiation may be misleading. But, not if you insist on a definite air and water capacity for the minimum power. On this basis, a Jennings Pump to handle any given amount of radiation can be obtained at a lower first cost.

BOOKLET GIVES BASIS FOR SELECTING HEATING PUMPS

There is just one way to be sure of getting the right pump for every job and, incidentally, of getting the greatest heating pump value. A new booklet, "Selecting a Vacuum Heating Pump", deals with this problem in detail. It will be sent, on request, to anyone interested in obtaining more for his heating pump dollar.

NASH ENGINEERING COMPANY, 81 WILSON ROAD, SOUTH NORWALK, CONN.

Jennings Pumps

Degree Days and Unit Fuel Consumption in Typical Cities

March, 1932

UNIT fuel consumption figures given below must be corrected for efficiency, heat content of fuel other than that listed below, for radiation emitting other than 240 B.t.u. per hr., and for radiation calculated on a basis other than zero outside to 70° inside.

Coal is assumed as having a heat content of 12,000 B.t.u. per lb., gas, 1000 B.t.u. per cu. ft., and oil, 140,000 B.t.u. per gal. To correct for other heating values, multiply the fuel consumption listed under the charts by the standard heat content just listed, and divide by the heat content of the fuel actually being used in the installation being calculated.

For radiation installed for any other outside temperature than zero, multiply the fuel consumption given under the charts by 70°, divided by the quantity (70 minus the outside temperature used).

To correct for efficiency, divide the fuel consumption by the efficiency of the heating installation.

For water radiation, multiply the fuel consumption which is given for steam radiation by 5/8.

	New York	Seattle	San Francisco	Chicago	Denver	Boston	St. Louis	Pittsburgh	Minneapolis
Degree days	864	577	245	1081	984	910	808	969	1274
Total degree days since September 1	3753	4019	2404	4467	4992	4367	3305	3919	6161
Lb. of coal per sq. ft. of radiation for March	6.912	4.616	1.960	8.648	7.872	7.280	6.464	7.752	10.192
Gal. of oil per sq. ft. of radiation for March	0.592	0.396	0.168	0.741	0.675	0.624	0.554	0.664	0.874
Cu. ft. of gas per sq. ft. of radiation for March	82.94	55.39	23.52	103.78	94.46	87.36	77.57	93.024	122.30

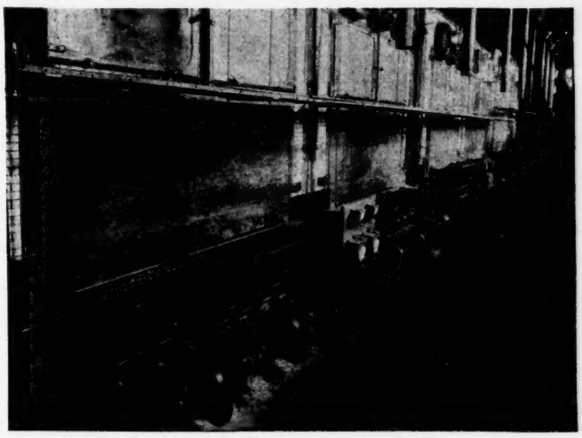
	Los Angeles	Baltimore	Philadelphia	New Orleans	Atlanta	Cleveland	Cincinnati	Detroit
Degree days	110	767	790	242	511	1054	896	1090
Total degree days since September 1	1288	3006	3243	646	1987	4142	3583	4585
Lb. of coal per sq. ft. of radiation for March	0.880	6.136	6.320	1.936	4.088	8.432	7.168	8.720
Gal. of oil per sq. ft. of radiation for March	0.075	0.526	0.542	0.166	0.350	0.723	0.614	0.747
Cu. ft. of gas per sq. ft. of radiation for March	10.56	73.63	75.84	23.23	49.06	101.18	86.016	104.64

	Buffalo	Birmingham	Indianapolis	Memphis	Des Moines	Kansas City	Louisville	Galveston
Degree days	1131	465	984	546	1075	891	816	243
Total degree days since September 1	4763	1680	3913	2115	5079	3869	3148	829
Lb. of coal per sq. ft. of radiation for March	9.048	3.720	7.872	4.368	8.600	7.128	6.528	1.944
Gal. of oil per sq. ft. of radiation for March	0.776	0.319	0.675	0.374	0.737	0.611	0.560	0.167
Cu. ft. of gas per sq. ft. of radiation for March	108.58	44.64	94.46	52.42	103.20	85.54	78.34	23.33

Fuel consumption figures must be corrected for local conditions as explained above.

FEDERAL, STATE AND MUNICIPAL

WORK



United States Military Academy, West Point, New York

Architects, Consulting Engineers, Officials, and Contractors, charged with responsibility for the selection of equipment for PUBLIC WORK, have approved DETROIT STOKERS. The record for satisfactory, continuous performance, with bituminous coal, available in various sections is acknowledged. Distinctive features of design and application, embodied in DETROIT STOKERS represent over thirty years experience in exclusive stoker manufacture. Thousands in operation. There is a DETROIT STOKER for every service.

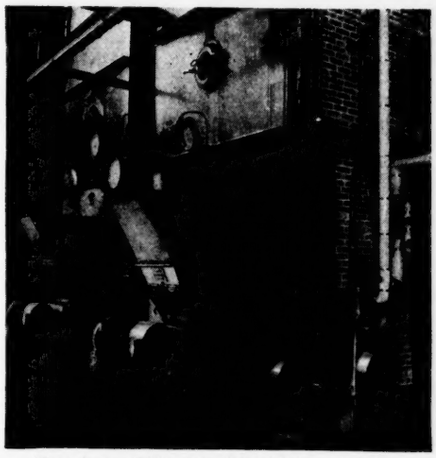
(partial list)

FEDERAL

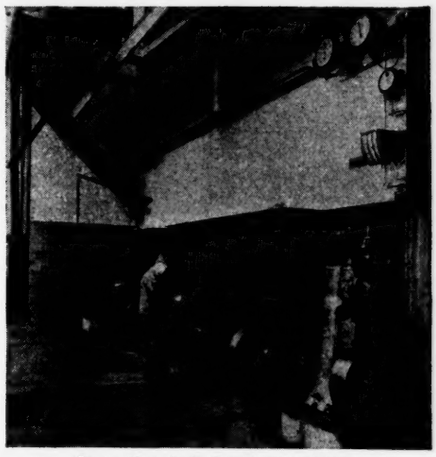
U. S. Veterans Bureau . Washington, D. C.
U. S. Veterans Hospital . . Bath, N. Y.
U. S. Veterans Hospital . Lexington, Ky.
U. S. Veterans Hospital . Johnson City, Tenn.
U. S. Veterans Hospital . Canandaigua, N.Y.
U. S. Veterans Hospital . Chillicothe, O.
U. S. Veterans Hospital . Columbia, S. C.
U. S. Veterans Hospital . Battle Creek, Mich.
U. S. Post Office . . . Brooklyn, N. Y.
U. S. Post Office, 3rd St. Sta., Cincinnati, O.
Federal Reserve Bank . . St. Louis, Mo.
Walter Reed Hospital . Washington, D. C.
St. Elizabeths Hospital . Washington, D. C.
U. S. Military Academy . West Point, N. Y.

STATE

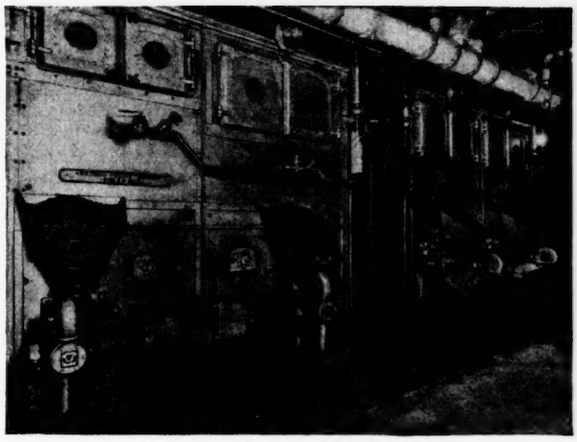
New York State Hospital, Raybrook, New York
Michigan State College, Lansing, Michigan
Kentucky Penitentiary, Eddyville, Kentucky
State Hospitals . . Petersburg & Marion, Va.
Georgia School of Technology, Atlanta, Ga.
State Teachers College . Kirksville, Missouri
Indiana Boys School . Plainfield, Indiana
University of Virginia, Charlottesville, Virginia
State Normal College . Richmond, Kentucky
State Normal Coll., Bowling Green, Kentucky
State Capitol . . . Richmond, Virginia
State Hos. for Insane . Waterbury, Vermont
State Hospital . Harding, Massachusetts
State Farm . . . Niantic, Connecticut
State Hospital . . Rochester, Minnesota
Indiana School for The Blind . . . Indianapolis, Indiana
State Colony for Epileptics . . . . Cambridge, Minnesota
State Institution for Feeble Minded . . Columbus, Ohio
State Teachers College . E. Radford, Virginia
State Teachers College . Farmville, Virginia
State Hospital . . Traverse City, Michigan
State Hospital . . . . Pontiac, Michigan
Colo. General Hospital . Denver, Colorado



Napoleon, Ohio—Municipal Water Works



State Hospital—Pontiac, Michigan



Columbus City Hall, Columbus, Ohio

MUNICIPAL

Cincinnati City Hall . Cincinnati, O.
District Jail . . Washington, D. C.
St. Louis Public Library . St. Louis, Mo.
Herman Kiefer Hospital . Detroit, Mich.
New York Penitentiary, Rikers Is., N. Y.
Municipal Plant . Penn Yan, N. Y.
Jackson Water Works . Jackson, Mich.
General Hospital, Minneapolis, Minn.
Municipal Plant . . Montpelier, O.
Oliver Water Works, South Bend, Ind.
Municipal Plant . Nicholasville, Ky.
City Hospital . . Springfield, O.
Water Works . Benton Harbor, Mich.
Lighting Plant . . Milford, Del.
General Hospital . Ashtabula, O.
Light & Water Works . Dover, Del.
Buffalo City Hospital, Buffalo, N. Y.
City Work House, Minneapolis, Minn.
War Memorial Aud. . Louisville, Ky.
Emergency Hosp., Washington, D. C.
General Hospital . Jamestown, N. Y.

WRITE FOR BULLETIN 873

DETROIT STOKER COMPANY

DETROIT, Mich. • *General Motors Bldg.* • Works at MONROE, Mich.

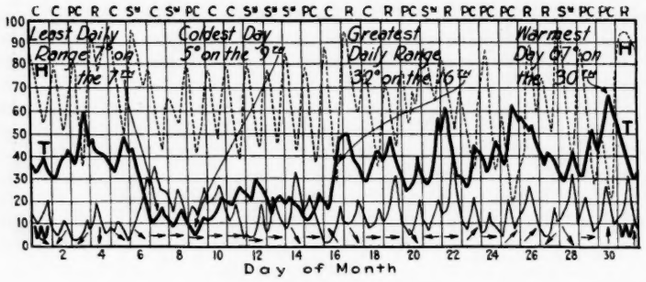
District Offices In Principal Cities

BUILT IN CANADA FOR CANADIAN TRADE

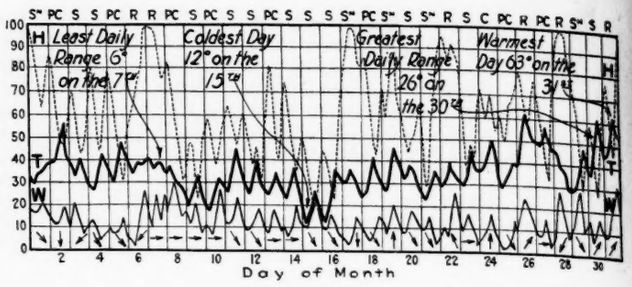
DETROIT STOKERS

The Weather

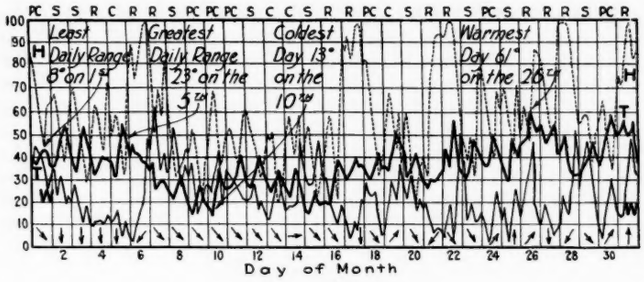
March, 1932


Least Daily Range 7° on the 17th
Coldest Day 5° on the 9th
Greatest Daily Range 32° on the 16th
Warmest Day 67° on the 30th
Day of Month

Pittsburgh

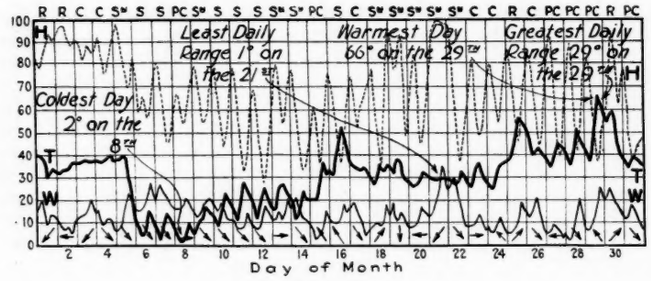

Least Daily Range 6° on the 7th
Coldest Day 12° on the 15th
Greatest Daily Range 26° on the 30th
Warmest Day 63° on the 31st
Day of Month

Boston

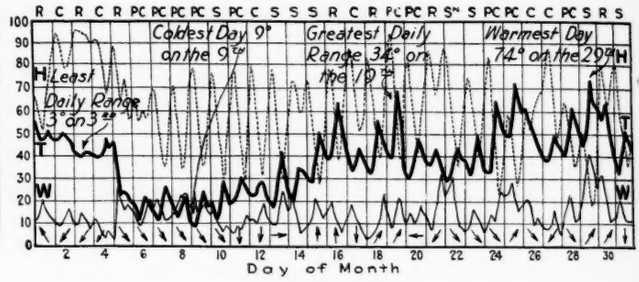

Least Daily Range 8° on 1st
Greatest Daily Range 23° on the 5th
Coldest Day 13° on the 10th
Warmest Day 61° on the 26th
Day of Month

New York

(Hourly Observation of the Relative Humidity Plotted on this Chart)


Least Daily Range 1° on the 21st
Warmest Day 66° on the 29th
Greatest Daily Range 29° on the 29th
Coldest Day 2° on the 8th
Day of Month

Chicago


Coldest Day 9° on the 9th
Greatest Daily Range 34° on the 19th
Warmest Day 74° on the 29th
Least Daily Range 3° on 3rd
Day of Month

St. Louis

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	61	63	67	66	74
Date of highest temperature	26	31	30	29	29
Lowest temperature, deg. F.	13	12	5	2	9
Date of lowest temperature	10	15	9	8	9
Greatest daily range, deg. F.	23	26	32	29	34
Date of greatest daily range	5	30	16	29	19
Least daily range, deg. F.	8	6	7	1	3
Date of least daily range	1	7	7	21	3
Mean temperature for month, deg. F.	37.0	35.6	33.6	30.1	38.8
Normal mean temperature for month, deg. F.	37.7	35.5	39.6	35.3	44.1
Total precipitation, this month, inches	5.52	5.28	3.24	3.10	1.33
Total snowfall, this month, inches	0.7	5.8	8.2	11.3	0.3
Normal precipitation, this month, inches	3.64	3 57	3.03	2 58	3.38
Total wind movement, this month, miles	15,505	8,440	9,227	9,227	9,869
Average hourly wind velocity, miles	20.8	11.3	12.4	12.4	13.3
Prevailing direction of wind	N.W.	N.W.	W.	N.W.	N.W.
Number of clear days	11	13	0	7	9
Number of partly cloudy days	8	8	9	10	12
Number of cloudy days	12	10	22	14	10
Number of days with precipitation	10	12	16	14	9
Number of days with snowfall	3	5	7	9	2
Snow on ground, at end of month	None	None	Trace	None	None

Plotted from records especially compiled for HEATING AND VENTILATING by the United States Weather Bureau.
Heavy lines indicate temperatures in degrees F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 a. m., 12 m., and 8 p. m.
S—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow. Arrows fly with prevailing directions of wind.

Heating and Ventilating

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Controlling the Ventilation of the Holland Tunnel

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District Heating Moves Ahead

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